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Forty-eight Inch Shaper.

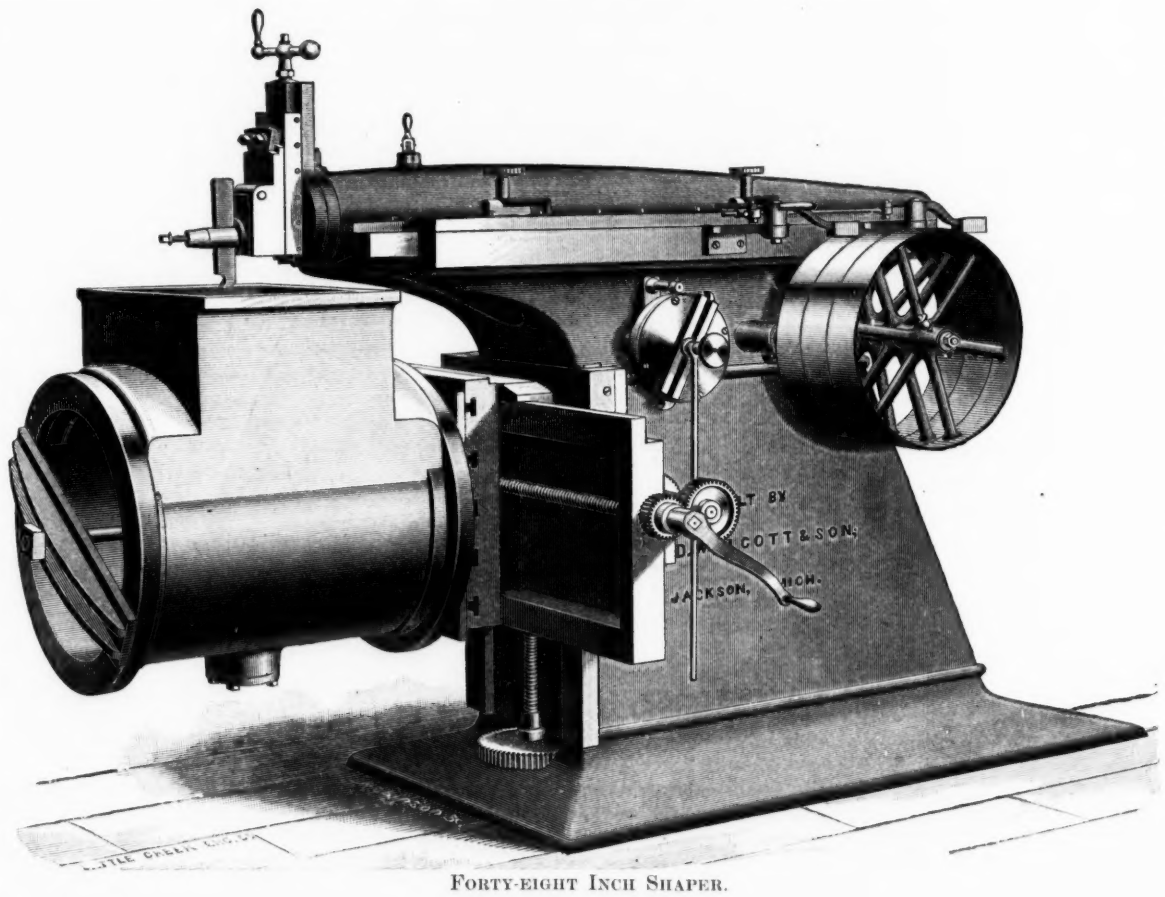
We give, on this page and on page 2, illustrations of an unusually large shaper, built by Geo. D. Walcott & Son, Jackson, Mich.

This shaper has a stroke of 48″, with a cross traverse of 40″. The driving mechanism is similar to that of a planer, so that a uniform motion is secured with any length of stroke, also a uniform quick-return.

The length of stroke may be changed by means of movable dogs on the ram without stopping the machine.

The support for the ram extends out over the platen in such a way as to give it the greatest possible rigidity. An opening through the bed below the ram admits of passing a shaft of any size up to 6″ diameter through, so that a key-seat can be cut in any part of it. The head, which swivels to 45° either way, has an automatic feed which may be adjusted from very coarse to very fine without stopping the machine. This is done by means of the small handle shown on top of the ram.

One of the cuts shows the shaper with the vise in place for ordinary work, such as is usually done on a shaper, and the other shows it with the horizontal platen removed, and an engine cylinder bolted to the vertical platen. In such a case it is customary to attach a boss to the platen, which just fits the counterbore of cylinder. This makes it easy to adjust the cylinder to position, and, in working on different parts of it, it is only necessary to loosen the bolt, and turn the cylinder on the boss. For this work the machine has been found very efficient, and to compare very favorably with a planer, very much surpassing it in points of convenience of setting the work, accessibility, etc.



FORTY-EIGHT INCH SHAPER.

The machines are furnished with graduated swivel chuck, and all necessary appurtenances, and weigh complete 6,500 pounds. When desired, other attachments are furnished, such as a mandrel for circular work, centers, attachment for key-seating pulleys, etc. Smaller sizes of the same design are built down to 15″ stroke.

Kaiser Wilhelm, of Germany, is getting a good deal of condemnation pretty much all over the world, because he is insisting that the workingmen in his kingdom have some rights that ought to be respected. German workmen *are* badly off, and if Wilhelm looks to it that they get some part of their rights, he will in the end get praise, where now he is getting abuse.

M. Walther-Meunier, chief engineer of the Alsacian Association of Steam Users, has devised a minute incandescent lamp, which can be very successfully used to examine almost inaccessible parts of the interior of a boiler.

The Interchange of Energy.

BY W. H. BOOTH.

Of the total amount of energy which is derivable from the combustion of fuel, few are really aware of the very small amount which is actually converted into actual net work

The term *net* work is variously understood.

For example, the theoretical evaporative duty of a pound of coal is, perhaps, 16 pounds for a certain quality, but when this coal is consumed under a boiler, the weight of steam produced is probably only 8 pounds. Some might call this the net work. Of the other eight pounds of duty much has become lost in space by radiation, more has performed work in producing the draught necessary to combustion, and a portion has run away in leakage.

Of the above eight pounds set down as net work, probably only two pounds is absorbed by the engine and converted into indicated horse-power, whilst six pounds have run away in the condenser, and been wasted.

We have here a net work of two pounds only, but we may go further and find by measuring the tension of the driving ropes that only one and a half pounds is registered as work outside the engine. In this way we go on and on until we arrive at the final stage, and what is this?

In a woolen mill, which has caused me to jot down these ideas, I cannot see that the final work actually utilized is of any appreciable amount whatever. This is a startling conclusion, but I believe strictly true. What is this small utilized residuum? It is simply the energy which is represented by the tendency of the fibers of the wool to occupy the form in which they originally existed. The spun threads tend to uncoil, and this tendency to uncoil might be made to do work again. If the product is worsted, *i. e.*, yarn made from combed wool, then there is also the energy due to curly fibers of wool being bent out straight. If freed they would curl again and do work.

Now the energy of all the wool spun in a day would probably, if put into the form of a weight, not tax the strength of a child for a minute—perhaps not for ten seconds. I have no idea how small it might not be. Where, then, has all the energy of the coal gone to? In turning machinery, shafting, etc., and in pulling asunder fibers of wool which resist such pulling, and in sliding over each other produce friction and heat. Every spindle and every bearing and tooth of the machinery runs with some friction, and this produces heat, and the bearing gets—? red-hot? No. It would get red-hot but for the law of radiation. Everything radiates heat, and the hot parts of machinery radiate so fast that, if well lubricated, the friction does not generate more heat than will pass away by radiation so quickly that the parts do not become sensibly warmer than surrounding parts.

Having lately been spending some time about the steam engineering of a woolen mill, it naturally occurred to me to find out where the energy of the coal really got to. As said above, I soon decided that nothing appreciable went away in stored energy in the fibers of the yarn, but that practically it all disappeared by way of friction as heat, and a roughly approximate proof was soon forthcoming. It appears that in winter time it takes about one ton of coal to warm the factory by night, but that steam is rarely required for the purpose of warming during the day. Taking the weekly consumption of coal as about 42 tons, I estimate about 21 tons to go to the engine as steam, or say 3½ tons daily. Of this amount we may perhaps assume one ton gets past the main driving gear as energy to turn the shafting, belts and textile machinery *within the building*. The actual amount of heat from the coal which gets inside the mill as work is thus the same as that used very economically by night to heat the building when the machinery is at rest.

In other words, the mill is heated by radiation from steam pipes during the night, and during the day it is heated by radiation from the revolving parts of machinery which are set in motion by the main engine, and so generate heat by friction. What an illustration this presents of the interchange of various forms of energy.

First we have the potential energy of stored-up sunlight in the coal. Next the heat of combustion of coal converted into molecular energy manifest in the elastic force of steam. Then we have the motion of the piston mechanically changed through multiple series into motion of textile machinery, and after all heat lost and dissipated in space through the walls and windows of the mill, the only portion actually effective in producing the result aimed at being the miserable remnant locked up in the springy quality of wool fibers. Truly a case of much cry and little wool, but a state of affairs which no one at present can see their way to remedy.

Seeing how very small indeed is the energy utilized, we can see how important it is that no effort should be spared to reduce the friction of machinery. Though useful as a means of warming a cold building, this method of generating warmth is wasteful, seeing that fivefold the quantity goes to waste in the condenser for each unit of heat given out through friction within the factory.

In any manufacture using steam power in the working up of various substances, the amount of heat finally changed into an altered condition of the material worked upon is very small. In spinning and weaving fibers we have already seen how little this is. In rolling iron to shape all work done reappears as heat, for the iron has no tendency to resume the ingot form. In pulverizing or grinding, the material has no tendency left in it to resume its original status, and generally in whatever way we look we see that all energy as such appears finally as heat, which is dissipated in space. As a rule, the warmth of a mill during working hours is attributed to the animal heat of the workers in it. A moment's thought shows how erroneous is this idea, for all the heat developed in the lungs cannot exceed that due to the amount of carbon burned, and this is only a proportion of the food consumed.

The heat derived from the machinery is not considered, simply because it is so widely dis-

tributed and is not intense, but it is impossible for it to be overlooked when thoughtfully considered.

Compound and Triple Expansion Engines.

BY JAMES B. STANWOOD.

III.

STRAINS IN RUNNING GEAR OF TRIPLE EXPANSION ENGINES.

In a general sort of way it is understood that the strains exerted upon the mechanism of compound and triple expansion engines are less than those in simple engines working at the same horse-power with the same boiler pressure and number of expansions. This fact is not so fully appreciated as the circumstances warrant. To illustrate what the reduction in strains amounts to, let us make a comparison between the working conditions of the usual type of triple compounds and a simple engine developing the same power with same boiler pressure and ratio of expansion. Figure 1 (page 3) is a theoretical indicator diagram supposed to have been taken from a simple condensing engine, without clearance, boiler pressure 150 pounds, vacuum four pounds; the steam, being cut off at $\frac{1}{12}$, expands twelve times. The greatest strain thrown upon the "running gear" of such an engine is the difference between the total boiler pressure acting on one side of the piston and the total exhaust pressure acting on the other side (the strains due to inertia or momentum of reciprocating parts neglected). The greatest strain in this case amounts then to the difference between 150 pounds steam pressure and four pounds vacuum = 150 + 15 — 4 = 161 pounds multiplied by the area of the piston. This amount is *twice* that developed in a non-condensing Corliss or Brown engine, boiler pressure 80 pounds; the mean effective pressure in the first case being about a pound greater than in the latter, with four expansions, makes the actual work done about the same. This clearly indicates that working with an increased number of expansions in one cylinder increases immensely the strains in the engine in proportion to the work done. If it were possible, then, expanding twelve times in one cylinder, to obtain better economy than expanding four times (which it is not) the engine would have to be twice as strong to do the work.

If, however, the twelve expansions are carried on in three successive cylinders, each operating its own crank, what are the results?

Suppose steam as before enters our first cylinder from a boiler at 165 lbs. absolute = 150 lbs. pressure by gauge, and exhausts into a second boiler in which steam is kept at 60 lbs. absolute pressure; the strain per square inch of piston area transmitted to the running gear of this cylinder will be 165 — 60 lbs. = 105 lbs. If steam from the second boiler at 60 lbs. is used in intermediate cylinder, which exhausts into a third boiler in which the pressure is 20 lbs. absolute, the strain exerted on running gear in this case is 60 — 20 = 40 lbs. for each square inch of its area. Finally if from boiler No. 3 steam at 20 lbs. is used by low-pressure cylinder exhausting into condenser at four pounds above a perfect vacuum, the strain here amounts to 20 — 4 = 16 lbs. per square inch. We have then for the maximum pressure producing strains in the running gear of these three cylinders: High-pressure cylinder, 105 lbs. per square inch; intermediate cylinder, 40 lbs. per square inch; low-pressure cylinder, 16 lbs. per square inch. But in practice the area of these cylinders varies; the high pressure, where the steam-pressure is greatest, has the smallest piston; the ratio of piston area of such cylinders is, in practice, about as 2 to 5 to 14. Therefore the strains will be as—

105 × 2 = 210 is to
40 × 5 = 200 "
16 × 14 = 224.

That is, the maximum strain exerted on the "running gear" of each of the cylinders is practically the same in each case.

But the boilers between the cylinders are not needed; for it is found that, with the proportions of cylinders as above, of about 2, 5 and 14, and with a careful adjustment of the cut-off on each cylinder, the same effect can be produced as if the boilers were present, as supposed; in fact, it has been possible to make each cylinder perform the *same work*, have the *same fluctuation of temperature* and exert the *same maximum strain on its running gear;* these really are the important features to be secured in all compound engines. How, now, do these results compare with the simple engine? As the low-pressure cylinder of a triple compound is a measure of its power, then if the "referred pressure" acting on same is identical with the mean effective pressure of the simple engine, the areas of both must be equal, to perform the same work. As, however, triple expansion engines do not develop more than 60 to 70 per cent. of the entire theoretical diagram, while a well-constructed simple engine will give about all of it, then to perform the same work the low-pressure cylinder would have to be larger. The mean theoretical effective pressure in the case we are discussing is 43 lbs.; in the triple compound it is at 70 per cent., 30 lbs. per square inch; therefore the low-pressure cylinder would have to be 43 ÷ 30 = 1.43 larger in area to do the same work. The strain transmitted to the running gear of the simple engine is 161 lbs. for each square inch of piston area; in the low-pressure cylinder of the triple compound it is 16 lbs., or $\frac{1}{10}$th of that of the former; but the area of the low-pressure cylinder being 1.43 greater for equal power, then we have 16 × 1.43 = 23 lbs., nearly. Thus 23 represents the strain in one case, and 161 in the other, or nearly as 1 is to 7. If the work in the simple engine is divided among three smaller cylinders whose combined area equals that of the single cylinder, the strains in the two cases will be as $2\frac{1}{3}$ to 1 in favor of the triple expansion engine. This fact shows how it is possible to save in weight in an engine when higher pressure is employed; while if the work were done in three separate cylinders, and pressure increased, the weight of engines would also have to be increased. This fact makes it also possible to construct engines of the enormous power now found; for it enables the largest shafts, castings, etc., that are possible to be made, to be combined into engines of twice the horse-power that it would have been possible to obtain without triple compounding.

As an example, let one of the engines of the "City of Paris" be considered; the cylinders are 45", 71" and 113" diameter, stroke 5 feet; if the revolutions are assumed at 90 per minute, the piston speed is 900 feet; with twelve expansions from boiler pressure of 150 lbs. a mean effective pressure referred to the low-pressure cylinder of 30 pounds per square inch can be obtained, giving the indicated horse-power as 8,200. The crank-shaft of this engine is about 26" or 28" diameter. Had this work been developed in three single simple condensing engines, the mean effective pressure being 43 pounds per square inch, with twelve expansions from same boiler pressure, the cylinders would have been each 55" diameter, constructed to stand 150 pounds boiler pressure, and a fluctuation of temperature of 213° Fahr. every stroke; the crank-shaft would have been 38" or 40" diameter. Such an engine could not have been operated at 90 revolutious, because of inability to cushion the piston of same for quiet running. The pressure on slides, crank-pins and bearings would have been $2\frac{1}{3}$ times greater than in the present engines; and, finally, the valve motion has not yet been devised that will handle steam under such conditions.

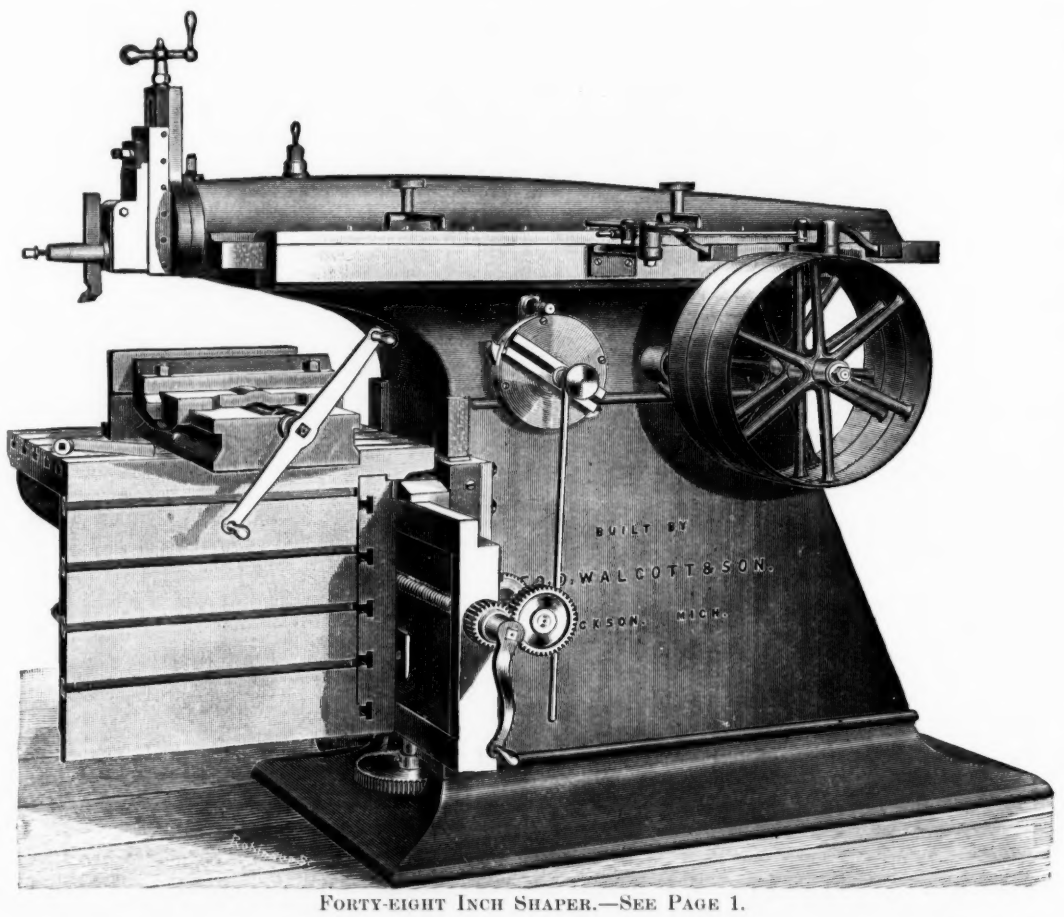
STRAINS IN CORLISS COMPOUNDS AND TRIPLE EXPANSION MARINE ENGINES COMPARED.

The greater number of expansions employed in Corliss compounds reduces the mean effective pressure that is obtained when referred to the low-pressure cylinder. Thus with cylinder ratio 4 to 1, cut-off on high-pressure cylinder one-fourth, expansions 16, boiler pressure 125 pounds by gauge, vacuum four pounds, a "referred pressure" of 24 pounds can be obtained under best conditions; such an engine then will require a low-pressure cylinder $1\frac{1}{4}$ larger than a triple compound of equal power expanding twelve times from 150 pounds boiler pressure with 30 pounds "referred pressure." In such an engine, too, the pressure at which the high-pressure cylinder exhausts to make strains on both engines alike—the cylinders supposed each to operate its own crank—will be about 31 pounds absolute, giving a maximum pressure transmitted to crank, per square inch of low-pressure piston, 31 — 4 = 27 pounds. We found this pressure in the case of the "triple" to be 16 pounds; as this 27 lbs. acts on a piston $1\frac{1}{4}$ larger, it is equivalent to 27 × $1\frac{1}{4}$ = 34 lbs. nearly, or twice that obtained by triple compounding. When the cylinders are placed "tandem" acting, through one piston rod, upon one crank, the strains are increased to four times that on any single crank of the "triple." This at first seems excessive; but in small engines material is not such an important factor as labor in its construction, and three cranks, connecting rods, crossheads, etc., though of less weight will, for certain sizes, cost more than one heavy crank, connecting rod, etc. When engines of large power are to be built the tables are turned, and the triple compounds have every advantage. It therefore lies with the engineer to determine when one type or the other is the most economical to construct and to use.

Corliss compounds have been and are built to operate at pressures lower than 100 lbs., but they give then a less economical advantage, and relatively large engines are required to perform small work. With steam at 85 pounds by gauge, and proportions as above, not more than 16 or 17 pounds "referred pressure" can be obtained. I have seen diagrams in which only 12 and 14 pounds were obtained; in this case the engine was underloaded. This underloading is often necessary where engines are put in sufficiently large for future needs, because the great number of expansions which one is compelled to use with them limits the maximum power obtainable.

Compounding is thus conclusively a device for using high-pressure steam, and its full advantages are not brought out unless high pressures are employed.

Compound engines, too, need condensers; not that non-condensing compounds are not economical, but the full advantage is not derived unless atmospheric pressure is removed. Non-condensing compounds especially need high pressures, and they should also be well loaded, or else, with low-pressure and light load, the low-pressure cylinder will be converted into a churn. Better results can probably be secured from a good non-condensing Corliss engine, with boiler pressure 80 or 90 pounds, than with non-condensing compounds; above 100 pounds these compounds may take the lead (with good loads). All these considerations point, then, to higher boiler pressure for better economy.



FORTY-EIGHT INCH SHAPER.—SEE PAGE 1.

Watches Set by a Bugle Call.

"Every watch and clock on Governor's Island is regulated by the Western Union ball time," remarked an officer of the Fifth Artillery the other day. "When Major Wallace F. Randolph, Inspector of Rifle Practice on Gen. Howard's staff, was in command of this post, he conceived and put in operation a plan which brought the 'time' of the island down to a fine point.

"Major Randolph directed that each day, just before noon, two enlisted men should be stationed at a point commanding an unobstructed view of the tower of the Western Union building. One of these was the post bugler, the other a trained signalman, equipped with a powerful field glass. The non-commissioned officer was required to keep his glass fixed upon the time ball. The instant it dropped, he gave the signal to the bugler, who stood in readiness, and the latter immediately sounded the specified call, which was heard all over the island, and forthwith there was a general consultation and adjustment of watches and clocks.

"The record is regularly posted on the bulletin at the guard quarters, and the tabulated statement in the Post Adjutant General's office affords a highly interesting exhibit. Governor's Island is the only military station in the country where official time is established by bugle."—*Providence Journal.*

Loam Moulding.

BY S. BOLLAND.

FIRST PAPER.

In treating of this very important branch of the iron founders' art, my object is to instruct the moulder in the details of his business, with the view to qualifying him to judge for himself as to the best way of accomplishing the work he may be set to do.

I am persuaded that, to qualify yourself for a loam moulder, you must master the principles which govern the trade. This once done, every new difficulty will serve to sharpen the intellect, and every day's experience will bring new knowledge, aided by which you will rapidly progress to the highest rank in your profession.

It is to be deplored that so many of our moulders have no fixed principles on which to base their operations. They grope along in the dark, and are constantly wondering how their work will turn out. I know men who are now working on very critical jobs, and are allowed to be first-class workmen, who, if they were asked to explain or give a reason for doing thus and so, would shrink from giving an answer, simply because they are ignorant, only "that it has been done before." The principles upon which they work have been laid down by some of the thinking men, and these are but mere copyists. I am much pleased at the efforts which are being made to enlighten such, and hasten to add my little ray to the light which is being directed towards the subject.

Loam work may be divided into three classes: namely, spindle, strickle, and pattern work, some jobs requiring all three systems for their successful working. We will at once commence work with the spindle on a very simple job, and, by strict attention to the instructions given, the rudiments of the business will be learned.

Required: A plain cylinder, 3 feet diameter and 6 feet long, with head cast on 6″ deep to receive the sullage, or dirt, which gathers as it is being cast (see Fig. 24). In the first place make foundation plate, Fig. 25, to carry the whole mould. The outside diameter of this plate must be 18″ larger than diameter of flanges, so as to give bearing for cope ring, which carries the outside of the mould. The diameter of hole in the center must be about 18″ smaller than the bore of cylinder, and will then allow of two courses of bricks in the core, should it be required, as it is sometimes when the casting is very deep. Let the plate be 2″ thick at least, and in all cases be sure to have sufficient strength in the bottom plate, because everything must be secured to it. Have the spindle fixed up at some place handy to the oven, if possible, and as well out of the way of the green sand floor as you can, on account of the rubbish which is constantly being made.

Spindles 10 feet long can be made of 2″ pipe, with one end welded up, and turned to fit the countersunk hole in the weight it turns in, this weight being bedded level with the floor. Make sure to have your spindle trued up good, as the truer the spindle is, the easier it is to make correct work. Such a spindle carefully used will serve your purpose as well as a solid shaft, and be much easier to handle.

The bracket being fixed to hold the top of spindle perfectly plumb, you are ready to commence operations Fig. 26 shows bottom plate resting on blocks, and it is very important that a good foundation be made for the blocks to rest on; for, should any of the bearings sink down under the load, great trouble ensues. Be sure that the bracket is firmly erected, as no reliance can be placed on work made under a spindle which works loose on the top.

The arm to which the sweep is attached may be made as shown at Fig. 27. It will

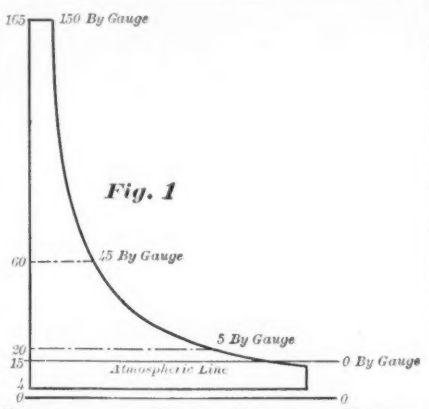


Fig. 1

COMPOUND AND TRIPLE EXPANSION ENGINE.

(See Page 2.)

be seen that a cap is inserted between the spindle and key, to preserve the spindle from dents. Observe that the side of arm to which the sweep is bolted must be on a line with center of spindle.

At *B*, Fig. 26, slot is shown for key. A good device is shown at Fig. 28 for securing sweeps, being a plate and set-screws, which has this advantage, that the moulder has not to hunt for a wrench every time to loosen or fasten his sweep. The plate can be made with any number of tapped holes to suit the job.

The first sweep required is the bearing which will take you up to the top of bottom flange shown in Fig. 24. Now, as this is to be not only a bearing, but a guide also, and, as you are required to take the impression of this guide in the cope, it must have

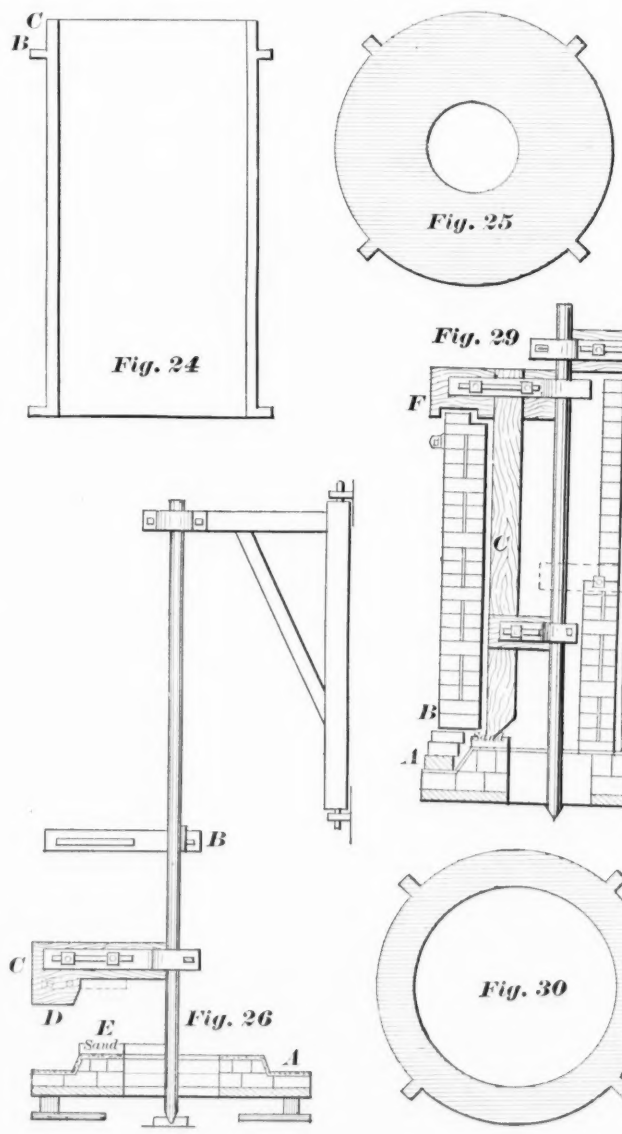


Fig. 24 Fig. 25 Fig. 26

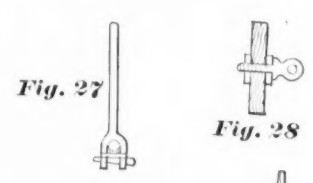


Fig. 27

Fig. 28

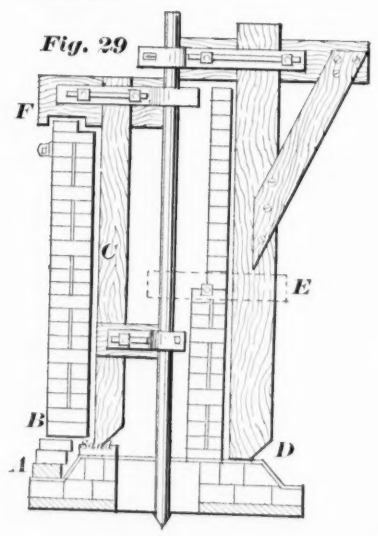


Fig. 29

Fig. 31

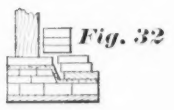


Fig. 32

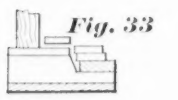


Fig. 33

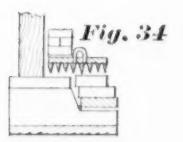


Fig. 34

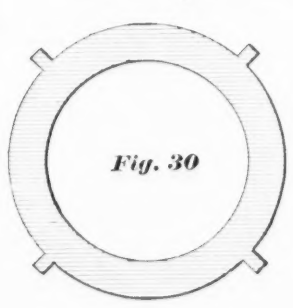


Fig. 30

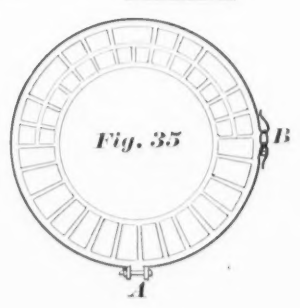


Fig. 35

a taper in its length, as shown at *A*, Fig. 26. By observing sweep as shown at *C*, Fig. 26, it will be seen that it is cut past the taper, exactly the shape of flange. As the first operation is to strike a bearing, as at *A*, you must screw on a thin strip, as shown at broken line, bring down the sweep to allow about one inch above brick at *D*. Ascertain that your sweep is square with the spindle and correct in diameter. You may then commence to build as shown at *A*, taking care that your bricks are not closer than half an inch to the sweep. Use mud made from the scrapings of the floor mixed with water, for building with. After the bricks are laid, rub on the loam and sweep off with board; bring up the corner as well as you can; if necessary, hang a charcoal fire over, to dry it sufficient to take the finishing coat or skinning loam, which is the regular loam thinned down with water and sifted.

A quicker way to make the skinning loam is to have the same proportions of sand without the manure, adding water to bring it to the proper consistency.

You now take off the strip of wood, and, when the mould is hard enough, throw on a little parting sand, and begin to form the flange in this manner: Have some old sand sifted fine and tempered, ram it on hard with the hands, pulling the sweep along carefully bit by bit, using your trowel to cut the superfluous sand away. By a little care you will succeed in forming the flange as shown at *E*. You must now dampen the sand a little and sleek down well, so as to be $\frac{1}{16}$″ clear of the sweep. You can now finish off with thin skinning loam.

Bearing and flange are now formed as seen at *E*, Fig. 26. The thing to be now done is to prepare it so that the impression can be taken clearly. The best way to do this is to go over the surface with coal oil, and throw on parting sand whilst it is wet; this makes the best separator for loam work. The reason for striking the flange separate on the bearing is because it is much easier to take the impression this way than it would be to form it by the cope sweep, as this would necessitate a finger on the bottom of the board, over which the bricks would have to be built, and fingers or long projections from the board are to be avoided as much as possible. Just think this over a little; it will be profitable.

The outside, or cope, is the next thing to be considered; to carry which a ring must be made as shown at *A*, Fig. 29. Let it be $\frac{3}{4}$″ clear of the guide, and wide enough to carry an 8″ wall, and, what is indispensable, strong enough to carry the cope without springing. A plan of this ring is shown at Fig. 30, where four lugs for lifting are seen, equally divided. Make it even and smooth, as it must rest on your bearing true, without any loam under it. After bedding down the ring, fasten on your sweep, as shown at Fig. 29. As will be seen, these sweeps are shown as being set against the spindle. This should save any measuring if they are made correct. But sweeps must be used, sometimes, which do not reach the spindle, in which case a gauge stick must be made, and marked off to the correct diameter—one is shown at Fig. 31.

You now commence to build, bringing your brickwork level with top of flange, where it is necessary to place your bricks endways in, as shown at *B*, Fig. 29. Rub some very wet loam on the under side of bricks as you lay them over the flange, taking care that you have at least $\frac{1}{2}$″ of loam between the bricks and flange.

There is a point here it would be well to notice. We suppose the flange in this case to be 3″ wide, and would stand as shown at Fig. 32. But suppose the flange to be as shown at Fig. 33, 10″ wide; it will be seen that the brick has no support whatever, and some other mode of working must be adopted. To overcome this difficulty a ring must be made in halves, about $\frac{3}{4}$″ thick, with prickers cast on $1\frac{1}{4}$″ long, as seen at Fig. 34. Let it be made 1″ clear of sweep, and, when cleaned off, throw on clay wash, and fill up level with prickers with stiff loam; when dry, clean off the dirt and soot, and bed down on the outside brickwork and over the flange, on about $\frac{1}{2}$″ of loam. You can then go on with your building as usual. Now follow on with the building, and keep clear of the board $\frac{1}{2}$″; and, when you have built as far as will permit of your reaching the bottom, you must soften your loam to the proper consistency, and rub it well on the bricks inside, sweeping off as you go.

In building long copes it is well to have a binding course of whole bricks end in about every six courses. Build open and fill in the spaces with fine cinders, keeping the smallest bricks to the inside. Fig. 35 explains what I mean. When the bricks are all laid, and the first coat of loam roughed on, procure a length of strong hoop iron with ears on, as seen at *A*, Fig. 35. If it should not be convenient to get the ears put on, you may bend the iron, as seen at *B*, and wind softened wire from one hook to the other, and give the strands a few twists with the prong of a file.

This hoop iron must be placed about the third course from the top, with mud between it and the bricks. This plan answers well to keep the mould stiff on such a cope as this, but when you have larger work, with feet, nozzles, lugs, etc., built in, you must cast a thin binding ring the width of the brick work to build in, in the place of the hoop iron.

Before skinning up your cope with the fine loam or slip, go over again with some thin, coarse loam to fill up every crevice and hole, as the fine loam is only intended for a finishing coat, to enable you to make a smoother casting.

In moulds which are too small to admit of a man working in the inside, you must fasten a hand brush to the end of a long staff, and rub or plaster your slip on with it, working the sweep round and round until the surface is smooth all over.

The spindle and sweep can now be lifted out, and the scaffold cleared away. Make good reliable marks at the bottom joint, so that, in closing back your cope, you will be sure to place it exactly where it was before.

During the year 1889, there were filed at the Swedish Patent Office 837 patents and 169 applications for the registration of trade-marks. Of the former, 466 were granted, and 148 trade-marks registered. During the previous year there were 803 patent applications filed, of which 505 were granted, and 207 trade-marks were applied for, 187 of which were registered.

An establishment at Leeds, England, is about to start in the building of small boats by stamping them out of a single sheet of metal.

New Sheet Metal Slitting Mill.

The accompanying engraving represents a machine used for trimming and cutting sheets of metal into strips of any desired width. The machine is technically known as a slitting mill, the subject of our illustration having some important improvements recently added by the builders, Blake & Johnson, Waterbury, Conn. These improvements have proven of value in improving the quality of work done.

This style of mill is termed a gang slitting mill, on account of its having several cutters or slitter blades, arranged on the arbors to cut a sheet of metal into the required number of strips, by passing the sheet between the cutters. The machine represented in the engraving is designed for slitting metal one-eighth of an inch thick, and fifteen inches wide, or narrower. The cut shows but four cutters or slitter blades six inches in diameter, one on each end of each arbor. By this arrangement of the cutters both edges of the sheet are trimmed.

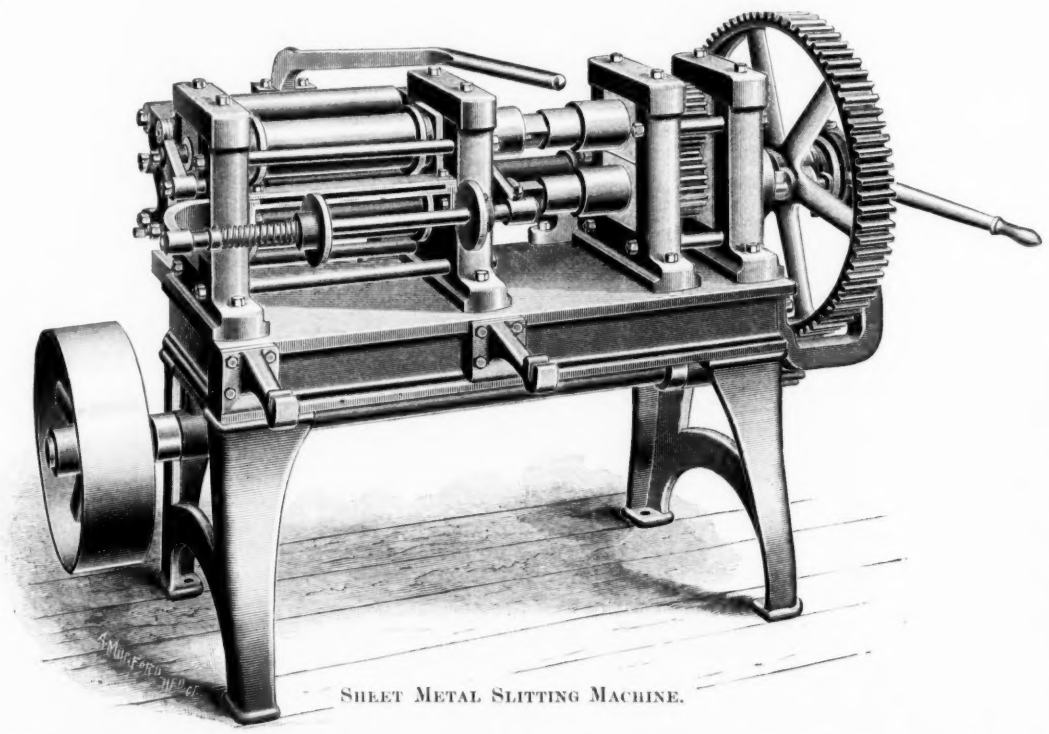
If it is desired to cut the sheet into several strips other cutters are placed on the arbors, the required distance apart, to make the strips the required width.

The improvements in this mill consist of a pair of steel rolls immediately back of the slitting blades, running at the same rate of speed as the blades or cutters, for the purpose of rolling down the burr that may be left on the edges of the strips, and to keep the strips flat so that they may be reeled up readily. The rolls prevent the strips coiling around the cutter arbors, as is frequently the case when this improvement is not used. They also assist materially in drawing the metal through straight. The top roll is adjustable so that it may be raised from its natural position by the use of the hand-lever by the operator when it is necessary to start in a new set of strips as they come from the cutters.

On the front of the machine are two brackets to hold a coil of metal, through which is passed an iron rod, resting on the brackets at either end.

The spring gauge in front of the cutters is another important feature. This consists of an arbor with a stationary flange at one end, and at the other a loose flange held in position against the metal by the coil spring which is shown in cut. Between this spring gauge and the cutters is a guide, and the spring gauge by its pressure against the side of the sheet guides the metal straight to the cutters.

The hand-lever at the right of the machine is for starting and stopping the cutters. By means of this lever a clutch on the shaft connecting with the lower cutter arbor is thrown out or in, producing an immediate starting or stopping of the cutters when necessary, while the driving shaft of the machine is in motion, it being driven from a countershaft overhead. The weight of the machine is 3,200 pounds.



SHEET METAL SLITTING MACHINE.

Recent Improvements in Foundry Practice.

BY WILLIAM KENT.

In a note contributed by Mr. Charles Wood, of Middlesbrough, to the discussion of Mr. Hadfield's paper on Alloys of Iron and Silicon (*Journal of the Iron and Steel Institute*, II, 1889, p. 253), he claims for himself, assisted by Mr. Stead, the discovery that silicon had the power of reducing the combined carbon into uncombined carbon, or in other words to convert white iron into grey iron. Experiments made at numerous foundries in France had completely established the fact, and confirmed the statements made by Mr. Wood at the Glasgow meeting in 1885. All the experiments made by Mr. Turner and Mr. Keep as to the power that silicon possessed to soften foundry castings, had been made since that time.

The practical value of this discovery had been as remarkable as it had been successful. Hundreds of iron foundries were now using a harder, and consequently a cheaper class of iron in their cupolas, producing castings of a better quality, being softer, stronger, finer on the skin, free from blow-holes, contraction or drawing, and, what was of equal practical importance, at less cost than before. Hard small scrap-iron, which hitherto could not be used, and was considered bad, could now be made, by the proper use of silicon iron, into the finest and strongest castings.

The custom of purchasing irons by their fracture, Mr. Wood said, in order to obtain sound castings, was a great mistake, and it must be abandoned. He admitted that hitherto it had been the only practical system known, and that founders, in order to make soft castings, had always gone to Scotch No. 1, or like rich brands, to mix with other qualities in order to produce this result; but he had shown that the commonest iron, such as mottled and white, could be reduced to any degree of softness by the proper mixture of silicon iron, and an iron founder, by following this rule, and studying analyses of the irons at his command, could now produce in his cupola the exact quality of iron most suitable to his castings, instead of, as hitherto, depending upon special and expensive brands, which were often very uncertain in producing what was required, although the fracture might be all that was desired, whilst the only explanation was to be found by analysis. The fact that the firm he had the honor to represent (Messrs. Wilson Pease & Co.), had made, and continued to make, many thousands of tons of silicon iron, which, prior to this discovery, was put back into the blast furnace, was a sufficient proof that both the theory and practice were sound, and that iron founders were daily leaving the old practice for the new.

The important practical value of the discovery thus claimed by Mr. Wood, is not more remarkable than that any "discovery" was needed to establish the fact. Dark grey or graphite pig-iron has long been known to contain a considerable quantity of silicon, while the same pig re-melted several times, or melted and "poled" in a reverberatory furnace, or exposed to oxidizing flames in the open hearth furnace, or partially blown in a Bessemer converter, lost more or less of its silicon, and became first close grey, then mottled, then white, hard and brittle. White pig-iron and hard scrap, on analysis, were also found to contain less silicon than grey iron.

But it was also known that, if the percentage of silicon were accidentally increased by too hot working of the blast furnace, above the normal amount present in open grey or dark graphite iron, the iron also became hard and brittle, worthless for ordinary castings, unless diluted with other iron, and was known as silvery, silver-grey, silicized, or carbonized, the latter being an incorrect term. This iron formerly was a drug in the market, and sold at low prices, just as white iron and hard scrap iron did. Silver-grey iron being hard and brittle from too much silicon, and white iron and scrap being hard and brittle from too little silicon, what more obvious inference could be drawn, than that, if these two irons were mixed in proper proportions, the silicon percentage could be made just right, and the resulting mixture would be soft and grey.

To some extent this was in fact done, and there was a limited sale, to stove foundries and others, for silver-grey iron to be used as a mixture, along with old scrap, but the mixture was made by a rule of thumb method, without any knowledge of the chemical analysis of the two kinds of iron. Now, however, chemistry steps in and gives a scientific reason why a proper mixture of silicized iron and old scrap will produce a tough and strong casting, and the result is that these once condemned varieties of iron, which were thrown into the blast furnace, to be made over again, are now highly esteemed and appreciated.

A somewhat similar practical benefit from the use of chemical analysis in foundry practice has been found in the manufacture of cast-iron car wheels. Some years ago it was thought that only the Hanging Rock or Salisbury cold-blast charcoal irons were good enough for car wheels, and these irons brought very much higher prices than any other irons. The chemists at length discovered that the peculiar characteristic of these irons was that they were lower in silicon than hot-blast and coke irons, and reasoned therefrom, first that if other irons could be found having identical analyses, they would be equally good in quality; secondly, that if the silicon in coke and other hot-blast irons could be reduced to the same percentage that existed in these cold-blast irons, either by partial blowing in a converter or by diluting the iron in the cupola with irons or steel that contained little or no silicon, such as steel rail ends, the same results would be found. Practical experiments demonstrated the truth of these theories, and now there is probably more iron used in making car wheels than the whole product of the Salisbury and Hanging Rock districts; these irons no longer bring the fancy prices, relatively to other irons, that they once did; irons formerly considered not good enough, are now in demand for the purpose; and the cost of the iron used in a car wheel is greatly reduced.

The time is probably not far distant when pig-iron for foundry purposes will be bought and sold on analysis, just as iron for Bessemer and other steel now is, and the results will be stronger and cheaper castings, more certainty in quality of product, lower prices for fancy brands of iron sold on their old reputations, and higher prices for scrap, white iron, silver-grey and other varieties hitherto undervalued.

Shop Notes.

One who visits the Philadelphia tool builders' establishments just now is likely to be strongly impressed with the fact that far heavier tools are to be the order of the day, and that with this there is also a much stronger tendency than formerly towards the use of heavy and specially designed machines, adapted specifically to the work to be done by the buyer.

Much of the success attained by our people in manufacturing has been due to their use of special machinery, but it has been mostly of the lighter and smaller class, such as is used for sewing machines, small arms, and work of a similar nature. There is evidence that those who are doing the heavier work—large stationary and marine engines, locomotives, etc., are beginning to appreciate the advantages of machines specially designed for the work they have to do, and they are having them built of the heaviest and best character. The demand for traveling and heavy swinging cranes is also constantly on the increase, and no one who is engaged in building heavy machinery nowadays seems entirely satisfied unless he has a crane which will pick up his heaviest casting—and, in fact, usually his heaviest completed machine—and deposit it wherever it may be wanted. This is making a lively demand for cranes, and The Yale & Towne Mfg. Co., The Morgan Engineering Co., and William Sellers & Co. are all doing a good business in that line. At the shops of the last-named company they have a number of cranes in process of construction of various sizes and weights, some of them driven by electric motors, which are placed in the cage and travel with the crane. The crane which they have recently put up over their erecting floor is driven in this way, and works in an entirely satisfactory manner. Among the other large tools to be seen on the floors are some exceptionally large and heavy planers; a 48″ lathe, 42′ 8″ long, and an angle shear to cut angle iron 8″x8″. The shear goes to the Chesapeake Dry Dock and Construction Co., the lathe to the Bethlehem Iron Co. A lathe has also just been completed which is to go to the new shops of the Pennsylvania Railroad at Altoona, which is something entirely new. It is to be used for facing off rock-shaft arms. It is fitted with mechanism which reverses the lathe at any desired point, giving it an oscillating motion, the backward movement being four times as fast as the forward or cutting motion. The lathe will make any part of a complete revolution desired, or can be used in the ordinary manner, *i. e.*, with continuous motion, at will.

At Bement, Miles & Co.'s shops plenty of evidence of the same tendency towards heavier tools is to be seen, among the heavier tools in process of building being a 120″ duplex lathe with a 45′ bed, and having four carriages; a 16½′ boring mill, 12′ high, and extending back sufficiently to take in work 24½′ diameter; universal drilling machine, 12′ wide and 12′ high under the spindle; horizontal boring machine, with two uprights automatically adjustable to any position on parallel slides, with a bed connecting them 6′ wide and 24′ long; 72″x72″ planer to plane 40′ long, and having four heads; wall planer to plane 22′ long and 20′ high; plate bending machine for plates 12′ to 16′ long, 1″ to 1¼″ thick; plate planers to plane at right angles two edges at once, for 1″ and 2″ plates 20′ to 28′ long; three 10-foot hydraulic riveters, one of them for a pressure of 100 tons; locomotive frame slotter having three heads, and to slot

four frames at once; and three 90″ driving wheel lathes. These are only the heaviest of the tools under way, there being, of course, many others nearly as heavy. They are mentioned simply because we can in no other way, perhaps, give so good an idea of the increased and hitherto unequalled demand for the heaviest tools. The work called for in connection with the building of the new naval vessels undoubtedly has much to do with this, though other work is being done with much heavier tools than formerly, and where some builders adopt them, others are, of course, forced to do so. Driving wheel lathes of 90″ swing are not common in this country, neither are frame slotters in which four frames can be placed one on top of the other, and having three heads to operate upon them at once. In this matter of heavy tools we have been behind European countries, and, of course, are yet far behind them in respect of the number and size of large tools employed, and there has, in the past, seemed to be little tendency to emulate their example. The indications are now, however, that the day is coming when America can hold her own in the building of heavy machinery as well as in the lighter kinds.

The new additions to the Bement, Miles & Co. shops, which have been spoken of before, are now fairly under way; the main walls, which are to support the heavy traveling cranes in addition to the floors above, being 30″ thick, and resting on a foundation three and a half feet thick.

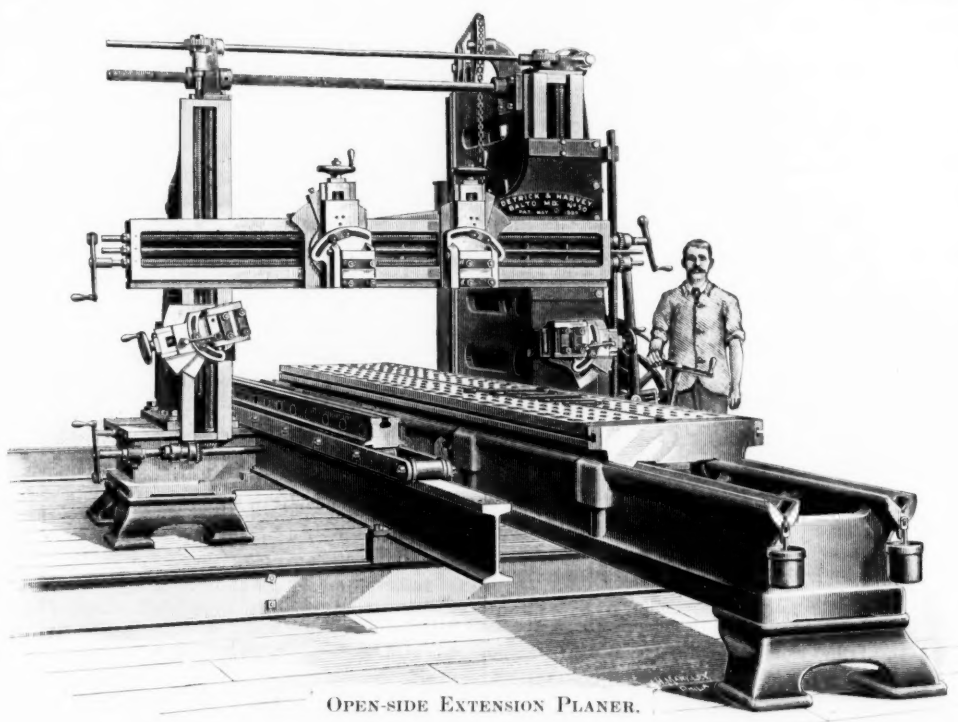
The Rue Mfg. Co., which has recently moved its shops into new quarters in a new building, now has things in very good shape —Mr. H. F. Colvin, who is at the head of the concern, evidently taking considerable pride in his special tools and appliances for doing the work on the injectors, which they make. The work is nearly or quite all of brass, and there are a considerable number of external and internal threads to be cut on the body of the injector, and the parts which fit into it. Plugs and receivers are provided for keeping these to a uniform size, and in every case taps are made with an extension below the thread, which is just a nice working fit in the hole to be tapped. This insures not only that the hole shall be the proper size, but that the thread shall also be true with the hole, and not cut deeper on one side than the other, as is apt to be the case in tapping brass. The principle of having inserted teeth in taps, adjustable for size, is followed out as far as possible, and the same is true of the dies. Mr. F. H. Colvin devotes his time principally to the devising and making of tools and fixtures, with which the work is done, and many of them are quite ingenious. A number of Fox lathes are used, and the method of cutting the threads on the end of the brass piece called the nut, which engages with the hob, is different from that usually employed. Instead of having hobs and hobbing it out, it is done with a single cutter, which is keyed into a boring bar, and the piece being clamped to the tool rest in the proper position, and the lathe geared up to cut a screw of the desired pitch, the operation is then the same as cutting a thread in the lathe in the ordinary manner. The distance which the cutter projects from the center of the bar is, of course, equal to the radius of the lead screw, so that the proper curvature is obtained.

The Barr Pumping Engine Co., though they are in new shops, have already outgrown them, and, to make additional room, have commenced having their castings made at an outside foundry, while what was their foundry is now used as an erecting and testing shop; the sand bins, which are of brick, and have been fitted with windows and shelves, answer admirably for stock rooms in which are kept the various parts and supplies needed in erecting.

Edwin Harrington & Co. have been building a good many tools, which, when finished, have been moved in next door, into the Baldwin Locomotive Works, and set to work. During the time when the machine tool business was not as good as it is now, they took a contract to build a number of paper-bag machines, some of which are just finished and at work in the shop, turning out bags from a continuous roll of paper, at the rate of 120 per minute.

Open-side Extension Planer.

Our illustration represents a new form of open-side planer, having an adjustable and removable upright, resting upon an extension of the bed provided for that purpose. This housing can be moved to or from the platen by hand, and, when adjusted to the position suited to the work to be done, can be clamped to the bed upon which it slides. The main or fixed housing is of massive proportions, and the cross-rail has a long bearing upon its face, in addition to a bearing at the extreme rear portion of the housing, in order to support it when used as an open-side planer. It is raised and lowered automatically by power. Besides the two heads upon the cross-rail there is one upon each upright, the former having automatic feeds in all directions, and the latter automatic vertical feeds.



OPEN-SIDE EXTENSION PLANER.

The movable upright can be so adjusted as to bring the head which it carries close to the work, regardless of its width, within the limits of the machine, thus making this head available at times when it would not be otherwise.

A supplementary rolling table is provided for supporting very wide work.

This planer, while it possesses all the convenience of operation usually found in a planer of its size, has the additional advantage of being able to handle an exceptionally large piece of work, such as is likely to occasionally come along in almost any machine shop.

They are made in sizes to plane 72″ wide by 48″ high, 10′ long, up to 120″ wide by 72″ high, 20′ long, by the builders, the Detrick & Harvey Machine Co., Baltimore, Md.

Sometimes steam engines, as well as coats and vests, for instance, appear to go because they are fashionable. A few years ago a new engine was put in a mill requiring about one hundred horse-power to drive the machinery. The chief object in placing the new engine was to have spare power in case of a break-down. The new engine was put working, and it was soberly estimated to be saving from ten to fifteen per cent. in fuel in comparison with the old one. Finally a new engineer took hold of the job, and, by cutting out the boilers that furnished steam for the engine from those that furnished steam for other purposes, he concluded, from actual trials for a year, that there was only only about five per cent. difference, and that was in favor of the old engine.

The American Patent System.

BY D. WALTER BROWN, PH. D.

IV.

CORRECTING THE PATENT AFTER ISSUE—DISCLAIMERS AND REISSUES.

It frequently happens, that after an inventor has obtained a patent for a *bona-fide* invention, the patent is found to be invalid, because either (1) the inventor has claimed things which he did not invent, as well as those which he did invent; or (2) the description and claims of the patent are too incomplete or too vague to furnish that full and clear information respecting the device and the claims, which the law requires.

In such case, our statutes say that the patent shall be valid for those things which the inventor did actually invent, if he will correct his patent so as to make those things clear, and so as to claim no more than those.

The methods of so correcting a patent, after it has issued, are two:

1. By disclaimers.
2. By reissued patents.

A "disclaimer" is what its name implies —to wit, a statement added to a patent, to the effect that certain things claimed in the patent are not the invention of the inventor who took out the patent.

This statement is made by an instrument in writing, addressed to the Commissioner of Patents, and signed by the patentee, or his assignee, and attested by witnesses. The disclaiming part runs substantially thus:

"Your petitioner hereby enters his disclaimer to that part of claim No. —— which is in the following words:"

[Then follow the words setting forth the things which were not first invented by our inventor.]

When such a disclaimer is filed, its effect is to limit the patent to what is the actual invention, and for all that not disclaimed the patent is valid.

In fact, even without the actual filing of a disclaimer, a patent is good for all those things which were the actual invention of the applicant, and a patentee can bring suit for infringement of such patent, before he files a disclaimer; but he cannot recover his costs in a suit unless the disclaimer was filed before the suit was commenced; and should he delay to file a disclaimer for an unreasonable time after he discovers that his patent claims more than he actually invented, he cannot maintain a suit on it.

No man is required to file a disclaimer before he has reasonably conclusive proof that his patent claims too much, and he has a reasonable time to file it, after such proof is given to him.

A disclaimer is proper when a patentee claims more than he had a right to claim; it is not proper when he claims not simply more than he had a right to claim, but some different thing; or when the specification and claims are not sufficiently complete and clear.

In these cases the correction should be made by a reissued patent, not by a disclaimer. The difference is this: A "disclaimer" is a brief statement that some particular things claimed in the original patent are not inventions; a "reissued patent"—commonly called "reissue" for short—is another complete patent—description, claims, and all—which takes the place in all respects of the original patent, and runs until the end of the original term. Thus, if an original patent were granted in January, 1890, to run until January, 1907, and a reissue were taken out in 1895, that reissue would run only until January, 1907.

A reissue is not an extension of the original patent, but is simply a corrected patent, which takes the place of the original in all respects. The original patent is surrendered to the Commissioner of Patents when the reissue is canceled and then ceases to exist.

The cases, when a reissue can be taken are the two stated at the beginning of this article—viz., (1) when the original patent claims more than the actual invention. (2) when the specification and claims of the original are not so clear and complete as the law requires them to be.

The statutory reasons for taking a reissue are, therefore, (1) to limit the patent down to the actual invention; (2) to substitute a clear and complete description and claims of the exact thing invented for imperfect ones.

For the former purpose a disclaimer may also be used, and a disclaimer is cheaper, and, perhaps, safer. For the latter purpose a reissue only is proper.

In taking out a reissue, the inventor must address a petition to the Commissioner of Patents, make a new oath of invention, and file a new specification and drawings, and state under oath the defects in the original patent. The oath of invention and the oath as to defects are united in a single affidavit.

The law requires that the specification of the reissue shall not contain any description of a material thing which was not described in the original specification, and that claims of the reissue shall not claim any invention which was not claimed in the original patent, or at least those distinctly stated to be a part of the invention intended to be claimed.

Our law limits a reissue to the correction of defects of description, and to the removal of claims which could not be properly claimed. It does not permit a reissue to add any substantial thing not contained in the original patent, nor to have claims broader than the original claims.

A reissue which does either of these forbidden things is void.

There is, however, a certain class of reissues, not expressly provided for by law, but allowed by the courts, which may have broader claims than the original patent had. To distinguish the two kinds, I have termed those described in this article "statutory reissues," that is, reissues expressly authorized by law, and the others "equitable reissues." These latter will be discussed in the next article.

English and American Pig-iron.

In the last trade boom we were so dependent upon American custom that questions are now being asked again as to the probability of an American demand to further develop our returning prosperity. And the spectacle of trade in the United States experiencing a quickening of a similar nature to that which is being felt throughout England has just recently caused the possibilities of American requirements to assume exceptional importance. Reasonable reflec-

tion will, however, show that a great American demand at present is not only improbable, but is also undesirable. The likelihood is that, if an American inquiry were experienced, it could only be by reason of a continuance of the development in the United States, and the occurrence of a relapse in Great Britain. It is not easy to see under what other conditions it would pay America to raise her imports of British metals, either in a semi-finished or a completely finished state, so far above the normal level as to greatly alter the course of British trade. Even if it were possible for a very large American demand to set in under conditions less unfavorable, what, situated as they are at present, could our manufacturers do with it? In nearly all departments there is as much work as can possibly be got through, and a large call from across the Atlantic, added to the present pressing requirements from home and from abroad, would lead to an utter disorganization of business. There have been times when immense shipments of English pig-iron have been made to the United States. If we had a return of a shipping boom of that sort concurrently with the existing scarcity of English coke, how could we meet it? In fact, so far from England being likely to export steel-making pigs in any large quantity this year to America, there are not wanting authorities who state that they would not be surprised to witness a total reversal of the usual conditions of trade, and before long to see America actually sending large quantities of pig-iron to England.—*Iron.*

"Marking of Iron and Steel."

We have received the following from the editor of *Industries*, which will explain itself. We can only say that it was our intention to credit the article properly, and that we are glad to make the correction:

In your issue of the 23d January, page 4, I note you credit our contemporary, *Iron*, with the suggestion as to the "Marking of Iron and Steel." This suggestion was first made in *Industries* (see our leading article in our issue of December 20th). Under ordinary circumstances I should not have troubled you, but the suggestion made by us is now being considered by the Iron and Steel Institute in this country.

The Watervliet Arsenal Gun Lathes.

On the first day of this month the Pond Machine Tool Works, of Plainfield, N. J., signed a contract for the building of ten lathes, which are to go to Watervliet Arsenal, West Troy, N. Y., and will be used in the manufacture of 8″ and 10″ guns.

The lathes are all of 96″ swing, but are not all of the same length. Six of them are for boring and turning, and are 100 feet long; the remaining four, which are for turning and finishing only, being 58 feet long.

They will be built mainly to designs furnished by the Government, but may be slightly modified in some particulars. They will be triple geared, having in all twenty different speeds, the gears being in the ratio of 42 to 1 and 300 to 1.

The turning and boring lathes will weigh complete about 200,000 pounds; the others 150,000 pounds. Thirty-seven months' time are allowed for the delivery of the lathes, with a penalty of $25 per day for delays. The contract price for the ten lathes is $247,800, which is at the rate of about 13¾ cents per pound.

There are but about four concerns in the country that are prepared to do such heavy work, and only two of these put in regular bids—the Niles Tool Works and the Pond Works. William Sellers & Co, however, offered to build lathes of their own design and guarantee their satisfactory performance.

Much interest is being taken in the approaching competition for the contracts to build some much heavier lathes for the Navy Department, and the price at which the Watervliet lathes have been contracted indicates that the competition is likely to be sharp, and that no very high prices will probably be obtained.

Reference to our issue of June 16, 1888, in which is a ground plan and full description of the Pond shops, will show that they are well arranged and fitted for work of this character, and it is altogether probable that the company will be among the competitors for the heavier lathes referred to above.

LETTERS FROM PRACTICAL MEN.

Testing Lathes.

Editor American Machinist:

In the issue of Feb. 6 Mr. B. Crank gives a very good way for testing the alignment of lathes. I don't see, however, why the test bar could not be made one foot instead of five. In my opinion, it would be just as correct, while having the advantage that it could be used in a small lathe that would not take five feet between centers. There is a cheaper way still, that some young fellows might not have heard of. Make a stick, say two or three times the length of the spindle—a broom handle will do very well if light—point one end off to fit in the live center hole. Saw the other off square, and smooth up with a fine file. Drive the stick in the spindle, start the lathe, not letting it go too fast. Mark a circle about ⅛″ diameter or so, by holding a very sharp pointed lead pencil up against the end of stick. Stop the lathe, and screw tail stock center up lightly, allowing it to make a slight mark on the stick. The location of mark and circle, as regards to each other, will plainly show if the spindle is true, or which way it ought to be moved if out of line. More could be said, but this will suffice to give an idea. Of course anything resembling a telegraph pole should not be used, but the stick should be made as light as possible. This might do a good turn some time when there is no time to make Mr. Crank's test bar.

Chicago, Ill. HERMAN FERNSTROM.

[This method will show if the spindles are much out of line with each other, but will not show if both are out of line with the bed.]

A Misunderstanding.

Editor American Machinist:

In your issue of Feb. 6th I notice, in your answer to W. S. L., concerning the paragraph in Mr. Rose's Modern Machine Shop Practice, that you think the quotation incorrect; but by referring to the volume in question I find it is correct. And I also find a mistake in another work by Mr. Rose, his Mechanical Drawing Self Taught, on page 63, where he gets the transverse and the conjugate axis of an ellipse interchanged. Now are we to conclude from these mistakes that Mr. Rose does not know what he is writing about? I think not, but rather that it is an error. I have read a considerable from Mr. Rose's writings, and (if I may be permitted to judge) I find him to be a very comprehensive writer, especially to those who have not had the very best of opportunities for an education. And again, are we to lay aside all mechanical literature because of a few mistakes incorporated within them? I ask the question, because there are those who argue in that way. It has often been said that "it is human to err," and who is there that can plead "not guilty" to the charge? and if such is the case we must expect to find mistakes in books; and they are not always chargeable to the author. Now, what is our conclusion?—only this: that we must read more than one author in our search for information, and must always apply thought and a little common sense to our investigations. And no doubt the more extended our practical experience, the better the result. E. O. S.

[E. O. S. misunderstands our reply to the question. We did not say that the quotation was incorrect, but said we assumed it to be correct. We said that Mr. Rose's statement was, in our opinion, incorrect.]

Interchangeable Lathe Centers.

Editor American Machinist:

It seems to me that "Tool-room" does not form the correct opinion of the reason that some object to interchangeable lathe centers.

I do not know of any one who thinks that it would be impossible, but that it would be impracticable.

He says that "because a thing is done," it follows as a natural sequence *that it can be done.*

I think that it is possible that it has not been *well* done by the use of such tools as he speaks of.

I have no faith in a reamer, however well made or used, to straighten or round a hole. It improves it, but comes a long way—in some cases—from making it perfect. The usual way of testing taper holes is not correct. The marking is put on the plug, and then, after turning it in the hole, look at the plug to see how it fits. It might mark the plug well, but not the hole. The hole might be out of round, and in other ways out of truth, and not be discovered. I say that the idea is impracticable, for I cannot see how the object would warrant the expense. I have seen lathes in constant use with the same centers for ten years. I think that with proper care it would be possible to make them last, in most shops, at least five. I cannot see the reason why any one should want to change lathe centers from one lathe to another. Mr. Cox seems to lay great stress on the good things to be gained, but it seems to me that the uses he puts center holes to are different from what is usual. I have in my experience seen but very few fixtures made to fit the center holes of engine lathes. Special fixtures are usually made to screw on the spindle in place of the face plate. Why doesn't some one advocate standard screw threads on lathe spindles? I do not know of any well-regulated machine shop where they use their engine lathes for drilling machines.

I do not know that it would be well to so design the bed of an engine lathe as to allow the owner to use it for a stove if he chose to.

Jarno writes of interchangeable pipe threads, and other things which are now adopted.

I know that stove pipes and tin pails are made to standard sizes, but, like Jarno's railroad crossing incident, and "the flowers that bloom in the spring," they have nothing to do with the case. There is a wide range of variation allowed in pipe threads, which the makers put to good use. I venture to say that, if pipe threads were made straight instead of tapering, that very few would fit well. If straight pipe threads were made the standard, and makers would have to conform or "close up shop," they would do so to an extent, but the variations and mistakes would make the system a nuisance. The only thing to be gained, that I can see, by the use of interchangeable lathe centers, would be that it might accommodate one or two shops who choose to keep their lathe centers in the tool-room.

I do not think that because some people choose a land of eternal ice and snow for their habitation, that it would naturally follow that all should be of the same mind. I think we can carry so-called tool-room improvements too far. Suppose all lathe chucks, back rests, change gears, face plates, tail stocks, and, in fact, every movable thing, was kept in the tool-room? We might carry this kind of improvement further—mount all the machine tools on wheels, like fire engines, with a scaffold attached to each carrying the countershafts. The workman could get them from the tool-room for a check, accompanied by an order from his superior officer. This would help to *fill up* the tool room, and so make the enterprising man in charge happy. We can carry these "left-handed improvements" one step more. Restore the original legs to each machine, and set them up in the tool-room. The workmen could go there and do their work. Now we have no tool-room.

There may be a time in the far future (I hope I shall not live to see it) when everything will be standard and interchangeable. Invention will then be a capital crime. Inventors would commit the crime for the reward, and so get rid of their miserable existence. If every one had to live in the same kind of houses, eat the same kind of food, dress the same, everything the same, life to a great many would be monotonous in the extreme. People would long for a change, if it was nothing better than that of death.

Some machine shops brag of their interchangeable system; everything is standard. It seems strange that in their shops it is quite common to hear the workmen ask at the tool-room window for the large one-inch mandrel. The fact is that some variation *is allowed*, not that a fair rate of perfection could not be reached at times, but that there are mistakes constantly occurring.

A fit on a two-inch shaft is .001 small; the hole is large. We do not know how large, for we have no way of measuring it, only with the two-inch plug. It seems too bad to throw this work away, so let it go. If the shaft had been fitted to its place this mistake might not have happened.

As long as these conditions do exist, and there is nothing to be gained by making lathe centers interchange, would it not be best to continue to multiply the tapers, and so compel users to fit their lathe centers where they belong, and so avoid all possible mistake?

I beg pardon if I am mistaken in my way of thinking, but it looks to me like a "great sweat for nothing." A MECHANIC.

Using Boiler Compounds.

BY T. T. PARKER.

Of the boiler compounds now on the market, perhaps 10 per cent. are sold in liquid form and even of the ones sold in powder form it is generally expected that they will be dissolved for convenience in using. Therefore, in speaking of the feeding of boiler scale-removers, I shall assume they are in liquid form.

To the minds of many persons directly interested in boilers using water containing scale, there is something mysterious in the operation of compounds; I have been shown samples of scale 1″ thick, supposed to have been removed by the compound; the scale resembling in texture a piece of limestone. That it would require something extraordinary to produce such results without softening the scale is indeed true; but people overlook the results of expansion and contraction, and give credit to a compound which could not do such work in itself. Not having put any thought on the subject, many engineers put in the quantity prescribed for the run, and, should the results be unfavorable, discard its use, adopting something else. They are constantly trying something new, and are the ready victims of the next drummer, if they escape the frequent visits of our mutual friend, the boiler maker.

Quite often, good results are obtained in changing from one fluid to another, credit being given the latter, when the fact is that the work has been done by both. Notably is this true when changing from the use of oil to an alkali fluid, or *vice versa*. Many a wonderful testimonial could be traced to such a source.

Assuming one has selected a proper compound, how shall it be fed? Let us look directly at the problem. The scale-making material in a given quantity of water is to be neutralized, so that it will not adhere to the iron. The compound contains material that, if present in the water, will do the work, assisted by a judicious use of the blow-off. The answer is, therefore, the *constant* injection of as much as is required, and no more, thus keeping the water in the boiler constantly impregnated with the compound. Say, for instance, it requires the injection of one per cent. of boiler fluid to accomplish the purpose; then the feed water should contain that amount of fluid, so that at all times the proper percentage will be present in the boiler. It will be better to connect to feed water than to feed directly to boiler, on account of the scale being removed from the pipes. With an open exhaust heater, I would prefer to introduce the compound after the water has left the heater, while with a closed heater I would, in most cases, do the reverse. Often it will be quite

a question just how to do this best, and a small size injector may be required. But the price of this should not stand in the way of doing the feeding constantly. Like cylinder oil is fed to the engine, should the required amount of boiler fluid be introduced in the boiler.

Having rigged up for such work, I should not expect, in a month, to find *all* the old scale fallen down, but would expect to find that the forming of new scale had stopped, and that the old was being softened. As it takes time to form a heavy scale, it should take some time for a boiler compound alone to remove it.

Many engineers introduce the compound in large quantities at widely separated intervals. This is wrong, for various reasons—one of which is, the sudden injection of a large amount is liable to cause foaming, or it may, containing acid or alkali, be taken up with the steam, and act to destroy the oil in the cylinder. Again, should it take hold the scale, as the agent says it will, the scale may fall on the bottom sheet, and test the ductility of the plate by an effort at bagging.

Supposing anything like the above does not occur, irregular feeding cannot be the best way, because, while at one time there may be a dangerous excess, it must soon give way to a constantly diminishing deficiency, and the scale-making again goes on.

Assuming that one is properly feeding this compound, it may be worth while to help the action of the compound, or rather to remove the slushy mud that is composed of the scale and fluid.

Should there be any tendency to foam, a surface blow-off will be of value; but, if not, one may expect to find most of the sediment in the mud drum, from whence it may be removed by systematic blowing off. But, as boilers are now largely being put in without the drums, it will be worth while in such a case, to have a large blow-off pipe, say 3", and the valve should be some feet from the boiler, thus allowing for the mud to settle in the pipe.

Blowing off should be the first thing in the morning, and before firing up, because then there is no circulation. Frequent examination of the boiler will be necessary to remove any sediment that may be resting on the bottom sheets.

While I do not believe the use of compounds is the best way to handle the scale, yet I have found the above the best way to handle compounds, and in this manner have got excellent results. As clean iron is desirable in a boiler, in order to transmit heat freely, so is clean water necessary, in order to quickly, quietly, and freely make steam; and, therefore, no scale-making material should be allowed to enter the boiler. After all, compounds are but a big, bulky, awkward pound of cure, that make the patient very ill, and are not to be compared to the elegant ounce of prevention, in the way of a first-class purifier. Who does not, in other branches of mechanics, have the same awkward way of getting at the cure rather than the preventive?

The Toggle Joint.

The toggle joint, such as is shown in Fig. 1, and others of modified form, are often used in machinery, and frequently problems relating to the force or pressure which a mechanism of this kind can exert present themselves. A toggle joint, shown in Fig. 1, is sometimes called an elbow joint press. In this particular case the power P is applied at A on the lever $A\ C$, which works on the fixed fulcrum C; and when the end A is depressed the link $D\ B$ moves the block D in a horizontal direction towards G.

The following problems now present themselves: What force will the block D exert against the upright G? Also, What will be the longitudinal stress on the link $D\ B$? The force which the block D can exert, also the stress on the link $D\ B$ will depend, not only on the pressure P applied at A, but also on the angle $B\ D\ H$; if, for instance, a pressure of 100 pounds applied at A, at the instant that the distance between the center B and the horizontal line $D\ H$ is equal to $B\ H$, as shown in Fig. 1, causes the block D to exert a force of 160 pounds in the direction $D\ H$, then this force will be increased as soon as the distance $B\ H$ is decreased. From the foregoing we conclude that, before we can find the force exerted by the block D, we must know or establish the angle $B\ D\ H$, or, in other words, we must know the exact position of the link $D\ B$. Hence our problem is as follows: What pressure will the block D exert in the direction $H\ D$, at the instant that the link $D\ B$ occupies the position as shown in Fig. 1?

Problems of this kind are generally solved by the aid of the parallelogram of forces, and it may here be stated that there is no principle in the whole range of mechanical science which is more important than the principle of the parallelogram of forces. But to understand this principle we must know how to represent a force by a straight line. Hence a few preliminary remarks may give to some of our readers a clearer conception of that which is to follow.

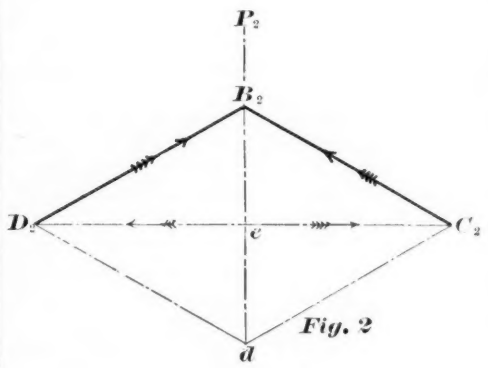


Fig. 2

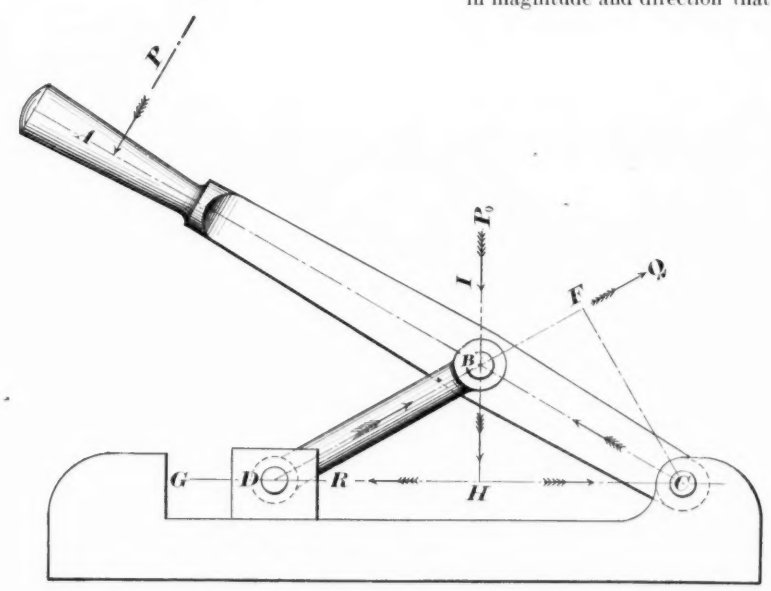


Fig. 1

THE TOGGLE JOINT.

A given force may be fully represented by a straight line; if the three following conditions are complied with.

1st. Magnitude. The straight line must contain as many units of length as the given force contains units of force or weight. Any convenient scale of equal parts may be employed, though a decimally divided scale is the most convenient. Thus, in Fig. 2, the line $B_2\ d$ may be made to represent a given force. If this force is equal to 5 pounds, and we adopt $\frac{1}{8}$ of an inch to represent one pound, then the line must be made $\frac{5}{8}$ of an inch long to represent 5 pounds; or, if $\frac{1}{8}$ of an inch is to represent 10 pounds, and the given force is 60 pounds, then the length of the line $B_2\ d$ must be equal to $\frac{1}{8} \times \frac{60}{10} = \frac{3}{4}$ of an inch.

2nd. Location. The line representing the force must either be parallel to or coincide with the line of action of the force. Thus, if the line $B_2\ d$, in Fig. 2, represents the force P_0 (Fig. 1), then $B_2\ d$ must be drawn parallel to the direction in which the force P_0 acts.

3d. Sense. The sense of a force is the direction in which it tends to move the body affected, and must always be indicated in some way. The usual practice is to indicate it by an arrow attached to the line representing the force. Thus the force P_0, in Fig. 1, acts downwards; if now $B_2\ d$, in Fig. 2, represents this force, we must attach the arrow to indicate that it is acting downwards.

Hence the line $B_2\ d$ drawn parallel to action of the force P_0, the former containing as many units of length as the latter contains pounds, with an arrow attached to the line $B_2\ d$, fully represents the force P_0.

The principle, which is called the parallelogram of forces, may be stated as follows:

If two forces acting on a point be represented in magnitude and direction by the adjacent sides of a parallelogram, then the resultant of the two forces will be represented in magnitude and direction by that diagonal of the parallelogram which passes through the point.

The resultant of two given forces acting upon a point is that single force which would exactly replace them and produce the same effect on the point acted upon as the combined effect of the given forces.

To show how the parallelogram of forces is applied, let the lines $D_2\ B_2$ and $B_2\ C_2$ (Fig. 2) represent in magnitude and direction two given forces, acting on the point B_2; it is required to find the resultant of these two forces. Through the extremity D_2 of the line which represents one of the given forces, draw a line $D_2\ d$ parallel to $B_2\ C_2$; again, through the extremity C_2 of the line which represents the other given force, draw a line $C_2\ d$ parallel to $D_2\ B_2$, meeting $D_2\ d$ in the point d; draw the diagonal $B_2\ d$. This will be the required resultant; or, we may say, the line $B_2\ d$ represents in magnitude and direction that force which by itself will have the same effect on the point B_2 as the combined effect of the two given forces. But it must be remarked here that, when the line $B_2\ d$ represents the resultant of the given forces $D_2\ B_2$ and $B_2\ C_2$, the arrow on the line $B_2\ d$ should point towards B_2, and not as shown in Fig. 1. The reason for showing it as we have done is that we believe it will show plainer the conditions of the original problem.

The foregoing operation of finding a single force whose effect is equivalent to that of two or more given forces, is called the composition of forces.

When the operation is reversed, it is called the resolution of forces; it is the operation of finding two or more forces whose united effect is equivalent to that of a given force. These forces are called components of the given force. Let us take an example. Suppose in Fig. 1 we have a pressure P_0 equal 100 pounds acting in a vertical direction applied directly to the center B; it is required to find the magnitude of the forces acting in the direction $D\ B$ and $B\ C$.

Draw the line $B_2\ d$ (Fig. 2) parallel to the direction of the pressure P_0 in Fig. 1; assuming that each inch is to represent 10 pounds of the pressure, we must make the line $B_2\ d$ 10 inches long. Through the extremity B_2 draw lines $D_2\ B_2$ and $B_2\ C_2$, the former parallel to $D\ B$, and the latter parallel to $B\ C$, in Fig. 1. Through the extremity d, draw the lines $D_2\ d$ and $C_2\ d$, the first parallel to $B_2\ C_2$, and the second parallel to $D_2\ B_2$, and thus complete the parallelogram of forces. Now, the length of the lines $D_2\ B_2$ and $B_2\ C_2$ represent the magnitude of the required forces, or the components of the force $B_2\ d$; and if these lines are 10 inches long, then each line will also represent a force of 100 pounds.

Now, let us proceed one step further. Let the sides $D_2\ B_2$ and $B_2\ C_2$ of the parallelogram represent the center lines $D\ B$ and $B\ C$ in Fig. 1, and let the diagonal $B_2\ d$ represent a pressure of 100 pounds applied on the center B; it is required to find the force exerted by the block D in the direction $D\ H$, and also the longitudinal stress on the link $D\ B$. Through the point D_2 (Fig. 2) draw a line $D_2\ e$ perpendicular to $B_2\ d$, also through the point C_2 draw another line $C_2\ e$ perpendicular to $B_2\ d$. In this particular case the lines $D_2\ e$ and $C_2\ e$ form one horizontal line, and of course must bisect the diagonal B_2 d. The line $D_2\ e$ represents in magnitude and the direction the force exerted by the block D, and the line $C_2\ e$ represents in magnitude the horizontal pressure on the fulcrum C; the downward pressure on the fulcrum C is represented by the line $B_2\ e$, this same line also represents the downward pressure on the block D; the sum of these downward pressures must be equal to the pressure P_0, and indeed this is plainly shown in our diagram, Fig. 2, because $B_2\ e$ is equal to one-half of $B_2\ d$, which we have made equal to the pressure P_0. The line $D_2\ B_2$ represents, as we have already seen, the stress on the link $D\ B$; and the line $B_2\ C_2$ represents the shearing stress on the pin C. If we now wish to find the numerical value of the magnitude of these several forces, we must measure the lines with the same scale as was used for laying off the line $B_2\ d$; thus, for instance, if we find that the line $D_2\ B_2$ measures 10 inches, and remembering that every inch represents 10 pounds, then this line will represent a force, whose magnitude is equal to $10 \times 10 = 100$ pounds. If the line $D_2\ B_2$ measures 10 inches, we shall find that the line $D_2\ e$ measures 8.66 inches, hence this line represents a force of $8.66 \times 10 = 86.6$ pounds. The line $B_2\ e$ will represent a force of $5 \times 10 = 50$ pounds.

If we change the angle $B\ D\ H$, we also change the forces $D\ B$ and $D\ H$, which must then be found in precisely the same way as the foregoing.

Now, assume that, instead of applying the pressure at B (Fig. 1), we apply it at A; let this pressure P be 100 pounds, acting in a direction perpendicular to the center line $A\ C$ of the lever; the distance from A to C is 16 inches. It is now required to find the force which the block D can exert in the direction $D\ H$ at the instant that the link $D\ B$ occupies the position as shown. Prolong the center line $D\ B$ towards F, and through the center C draw a line $C\ F$ perpendicular to $D\ F$. Now, let us take the center C as an axis of moments, $F\ C$ will then be the lever arm of the force $D\ F = Q$, and considering P and Q to be in equilibrium, we have $P \times A\ C = Q \times F\ C$, consequently $Q = \frac{P \times A\ C}{F\ C}$ (1) Suppose we find by measurement that $B\ D$ is 10 inches, and $B\ H$ 5 inches long, then $F\ C$ will be 8.6 inches long. Substituting for the symbols their values in equation 1, we have $Q = \frac{100 \times 16}{8.6} = 186.04$ pounds, which is the longitudinal stress on the link $D\ B$. Through the center B draw the vertical line $B\ H$, and through D draw the horizontal line $D\ H$, meeting $B\ H$ in H. Now, $D\ H$ represents the force exerted by the block D in a horizontal direction, and since this force is as much less than Q as the length of $D\ H$ is less than $D\ B$, we have $\frac{D\ H}{D\ B} \times Q =$ horizontal force exerted by the block D; and since $D\ H$ is 8.6 inches long, we have $\frac{8.6}{10} \times 186.04 = 159.99$ pounds. Prof. W. G. Peck, in his Elements of Mechanics, gives the following demonstration:

$$P \times A\ C = Q \times F\ C \text{ or } Q = P \times \frac{A\ C}{F\ C}.$$

If we draw $B\ H$ perpendicular to $D\ R$ we shall have,

$$\cos B\ D\ H = \frac{D\ H}{D\ B};$$

but we have, for the component R,

$$R = Q \cos B\ D\ H = Q \times \frac{D\ H}{D\ B}$$

Substituting for Q its value, and reducing,

$$\frac{R}{P} = \frac{A\ C}{F\ C} \times \frac{D\ H}{D\ B}$$

From the above demonstration we have,

$$R = \frac{A\ C \times D\ H}{F\ C \times D\ B} \times P \quad (2)$$

Substituting for the symbols their values, we have,

$$R = \frac{16 \times 8.6}{8.6 \times 10} \times 100 = 160 \text{ pounds,}$$

practically the same as before. In another issue we shall examine the results, when the $D\ B$ and $B\ C$ are of unequal length; also the rate of change of the force R.

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CONTENTS.

	PAGE.
Forty-eight Inch Shaper	1
The Interchange of Energy. By W. H. Booth	1
Compound and Triple Expansion Engines. By James B. Stanwood	2
Watches Set by a Bugle Call	2
Loam Moulding. By S. Bolland	3
New Sheet Metal Slitting Mill	4
Recent Improvements in Foundry Practice. By William Kent	4
Shop Notes	4, 5
Open-side Extension Planer	5
The American Patent System. By D. Walter Brown, Ph. D	5
English and American Pig Iron	5, 6
"Marking of Iron and Steel"	6
The Watervliet Arsenal Gun Lathes	6
Letters from Practical Men: Testing Lathes. By Herman Fernstrom—A Misunderstanding. By E. O. S.—Interchangeable Lathe Centers. By A Mechanic	6
Using Boiler Compounds. By T. T. Parker	6, 7
The Toggle Joint	7
"National" Building and Loan Associations	8
Practice	8
Literary Notes	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

"National" Building and Loan Associations.

It may be expected almost as a matter of course that, when any particular line of business is so conducted as to merit the especial confidence of the people, it will no sooner gain that confidence than some attempt will be made to use its good name for the purpose of advancing some scheme which, to the superficial observer, may resemble very closely the original, and yet really possess vital points of difference. This has turned out to be the case with building and loan associations. The principal feature tending to secure safety in the conduct of such associations is the fact that their operations are confined to a particular locality, which is familiar to every menber, so that no officer can be elected who is not well known to at least a majority of them, and no transaction of any kind can be carried on by the association without giving all the members the fullest opportunity for investigating it. Moreover it is customary for all the officers except the secretary to serve without compensation, and thus the business, while it has the advantage, usually, of excellent business management by men directly interested in the success of the association, and who are best acquainted with the peculiar local conditions, its business is carried on at the minimum expense.

The so-called "national" associations, whose operations extend over the whole country are necessarily without these features, which are the principal assurances of a safe and straightforward business.

The result of conducting a business of that nature without these features is seen in the case of the American Building and Loan Association, whose headquarters are at Minneapolis, and whose membership is scattered over nearly or quite every State north of the Ohio river. The Public Examiner of Minnesota finds that it has cost the association $300,000 to conduct a business of $1,200,000 two years, which is just 25 per cent. for the expense of operation; and at the end of the two years, instead of showing a gain for the stockholders, the books actually show a deficiency of $74,718.28, or nearly 6 per cent. of the entire amount received. The officer referred to has recommended that the Attorney General order the concern to wind up its affairs, and quit business, which will probably be done, and the sooner the better. The association was able in many instances to take advantage of State laws passed in the interest of local associations, and a special effort seems to have been made to secure, as members of each local board, men of prominence in the given locality. It is said that special inducements were held out to such men. If this is true, it is to be hoped that prominent men who have allowed their names to be used to help out the scheme, in consideration of special terms more advantageous than those offered to poorer members who were intended to be influenced thereby, may in some way be held responsible for at least a part of the loss falling upon those poorer members.

It is not unlikely that laws may now be passed in most States which prevent the so-called "national" associations from doing business outside of the State where organized, but in the meantime we advise our readers to confine their investments of this kind to local associations, which have undoubtedly done in the past, and are yet doing immeasurable good.

Practice.

It is said that practice makes perfect, and, in the main, this is undoubtedly true; but we think there are exceptions to the rule, a fact which we have known people to overlook.

For instance: A short time ago we heard a mechanic lamenting the fact that his handwriting, which had formerly been very good, had been ruined by continuous use of the pen, made necessary by a new position which he had assumed, in which much writing was required—a case in which practice seemed to have made imperfect. On the other hand, it happened that about the same time we heard another mechanic congratulating himself upon the improvement in his hand-writing, caused by the fact that, having accepted a position requiring much writing, he had been given an opportunity to practice and improve—a case in which the old saying is borne out, and which seems at first to be entirely inconsistent with the other.

The difference was undoubtedly in the kind of practice—one man taking no pains to form good habits of penmanship, while the other did take such pains.

It is much the same in working at the machinist's, blacksmith's, moulder's or other trades. Practice in these may make perfect, or it may make imperfect, depending upon the kind of practice. We have all seen workmen who seemed careless, slovenly and indifferent when at work, and who seemed to know less and less, and turn out meaner and poorer work the longer they lived. Practice seems never to make such men anywhere near perfect, but, on the contrary, each succeeding job seems worse than the last.

Yet it often happens that such men are the very ones who put the most implicit faith in the old saying that practice makes perfect, and, when anyone seems to doubt the perfection of their work, or the superiority of their knowledge, they point to their years of experience and practice, evidently seeming to think there is nothing more that can be said on the subject. When another, with perhaps half the experience and practice, but that of the right kind, is preferred over them, they are very apt to think that an injustice has been done them.

As with individuals so it is with shops. A shop may become better or worse as it grows older and gains experience, depending upon the kind of management it may have.

We have all seen shops which seemed to deteriorate from the first day they were started, while we have seen others that continually improved. An equal number of years would give each kind of shop the same amount of experience, but the experience is of a totally different character—the one tending constantly to develop towards perfection, while the other takes the opposite direction.

Practice of the right kind, and that which is continually improved upon, does make perfect; no other kind does, and no one should claim superiority of attainments simply by reason of greater practice, without being sure that that practice has been of the right kind. Practice in seeing how poorly a thing can be done does not make perfect and is not to be boasted of.

Literary Notes.

PRACTICAL BLACKSMITHING. Volume II. Compiled and edited by M. T. Richardson. Illustrated. Published by M. T. Richardson, N. Y.

We have no doubt this book will be as well received as the first volume was. There is room for a work of this kind, and the matter has been contributed by practical men—men who write from experience rather than theory. Mr. Richardson is doing good work in adding to the available literature of blacksmithing. The book sells for one dollar.

THE STEAM ENGINE AND THE INDICATOR: Their Origin and Progressive Development. Including the most recent examples of Steam and Gas Motors; together with the Indicator, its Principles, its Utility, and its Application. By William Barnet LeVan. Illustrated by 205 engravings, chiefly of Indicator Diagrams. Philadelphia: Henry Carey Baird & Co., 810 Walnut Street.

Mr. LeVan, as is well known to many of our readers, is a practical engineer and mechanic; hence, as might be expected, he treats such subjects as he discusses from a practical standpoint. The work begins with a history of the steam engine, and gives a good many facts in relation to this part of the subject. Unfortunately, but little is known in relation to the early use of steam, and it is well to treasure that little. A large number of indicator cards are shown, and their peculiarities explained in a plain manner. These will interest the engineer in charge of a steam engine, and help to impress more fully on his mind the value of using the indicator.

Altogether, the author has prepared a book that will help many readers to a better knowledge of the use of steam, and to that extent is a benefactor. The book is a large one—of more than 450 pages, and sells for $4.00.

"How to Make Electric Batteries at Home," is the title of a little book by Edward Trevert, published by the Rubier Publishing Company, Lynn, Mass. The intention of the author is to show amateurs, and those interested in such matters, how to make batteries at a small cost. No doubt many will find the book instructive. It sells for 25 cents.

We have received Vol. 10, 1889, of *The Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Company. This comprises the numbers of that publication for one year, neatly bound, and indexed conveniently for reference. It is needless to say that it contains a good deal of useful information. Every engineer should have a copy. We believe it sells for one dollar.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(67) J. B. W., New York, writes: I have a number of drawings, 24x14½ inches; they are rolled up, and when I want to use them they tear. I wish you would advise me how to preserve them, and how much it will cost. *A.*—Mount them on cloth; if you cannot do it, probably the best person to take them to will be a bookbinder; he will also give the price. After they have been mounted do not roll them up, but keep them in a portfolio.

(68) W. E. F., West Medway, Mass., writes: Please inform me if I can lift water with an ordinary suction pump through a height of 24 feet; the pipe consists of two vertical branches, each 12 feet long; one of these is attached to one end of a horizontal pipe, the other to the opposite end of the same pipe. *A.*—You do not state the diameter of the pipe, neither the amount of water to be lifted. If the pipe is not less than one inch in diameter, you can draw water through it slowly.

(69) W. H. L., Augusta, Ga., writes: I desire to change the form of packing in a hydraulic press, or use the old one and the new form together. To do so I shall have to bolt a ring to the cylinder having a recess for the new packing. The ring is 5½ inches deep, 20 inches outside diameter, and 10 inches inside diameter. Is it practical to bolt this ring to the cylinder with steel bolts? *A.*—Yes, providing you use mild steel; we would prefer iron bolts. 2 How many bolts will it require? What should be the diameter of the bolts? And how far should they be tapped into the metal? *A.*—Eight bolts, ⅞ inch diameter, tapped about 1½ inches into the metal.

(70) Apprentice, Brooklyn, N. Y., asks: 1. How are blue prints made? Can more than one print be made from a drawing? *A.*—Blue prints are generally made from tracings. You can make any number of blue prints from one tracing. The method for making blue prints is explained in answer to Question 449, in our issue of Nov. 5, 1887. 2. How can I find the terminal steam pressure on a piston? The initial pressure is 60 pounds; valve cuts off at ⅔ of the stroke; diameter of cylinder, 17 inches; stroke, 34 inches. *A.*—Multiply the initial steam pressure per square inch by the fractional part of the stroke at which the steam is cut off; the product will be the terminal pressure. Thus $60 \times \frac{2}{3} = 40$ pounds terminal pressure per square inch. 3. Is there any other rule for finding the horse-power of a boiler besides that of allowing 15 square feet of heating surface per horse-power? *A.*—Yes; sometimes the horse-power of a boiler is rated by the amount of water it can evaporate per hour. 34½ pounds of water evaporated from and at 22 degrees Fahr. is considered to be one horse-power.

(71) M. P., Buffalo, N. Y., writes: We are about to build a vertical conveyor to lift 568 pounds through a height of 36 inches; the constant load will be 284 pounds. We can make the sprocket wheels and driven pulley 4 inches diameter, and driving pulley 24 inches. Or we can obtain the same result by making the sprocket wheels and driven pulley 14 inches diameter, and the driving pulley 28 inches diameter. Please inform me which of the two methods is the best one? *A.*—

We should adopt the second method, because the sprocket wheels are larger than in the first method. The result in the two methods will not be exactly the same as you state. In the first method the chain will travel through a distance of 75.36 inches for one revolution of the driving pulley. In the second method the chain will travel through a distance of 87.96 inches for one revolution of the driving pulley. The third method which you mention may be suitable, but we prefer the second. 2. How much power will it take to run the conveyor, including friction? *A.*—Impossible to say unless we know the speed at which it is run, and know more about the details of construction.

(72) J. B. W., New York, writes: Please advise me as to the best way to proceed for obtaining a patent. I do not wish to give any information in regard to its construction or its use. *A.*—We see no other way than to give the whole matter to a reliable patent solicitor. 2. How much water will a tank 7 feet long, 6 feet 10 inches diameter, hold? *A.*—Multiply the length in feet by the cross-sectional area in square feet; the product will be the number of cubic feet which the tank will contain. Thus the area of 6 feet 10 inches = 36.67 square feet; hence the tank will contain $36.67 \times 7 = 256.69$ cubic feet. One cubic foot contains 7.48 gallons, consequently the tank will hold $256.69 \times 7.48 = 1,920.04$ gallons. Or, if the weight of the water is required, and assuming one cubic foot of water to weigh 62.5 pounds, we have $256.69 \times 62.5 = 16,043.12$ pounds, which is the weight of water in the tank. 3. How much water will a tank 8 feet long, 6 feet 6 inches deep and 6 feet wide, hold? *A.*—$8 \times 6.5 \times 6 = 312$ cubic feet. The number of gallons or weight of water can be obtained in the same way as in the previous example. 4. What will be the weight of a column of water? *A.*—Multiply the number of cubic feet which it contains by the weight of one cubic foot of water; the product will be the weight of the column. 5. What will be the weight of coal in a bunker 21 feet long, 7 feet deep, 5 feet wide? *A.*—The bunker will contain $21 \times 7 \times 5 = 735$ cubic feet. A cubic foot of broken coal will weigh about 50 pounds; hence the weight of coal in the bunker will be about $735 \times 50 = 36.750$ pounds.

(73) F. W., Chicago, Ill., writes: Your answer to Question 22, in your issue of January 16, 1890, is not correct. Priming could not cause it. It is caused either by foaming or globules of steam formed under water and raising out of the water, some of the globules taking a path through the water glass. This action is quite common in some locomotive and other boilers, and is not dangerous, although it shows that something is not quite right; it may be the proportions of the boiler. *A.*—It seems to us that you have read our answer in a hurry, and somewhat carelessly. We stated that the probable cause of priming is that the steam space is too small; you say it may be the proportions of the boiler. Consequently, so far as it relates to the cause, we agree. Now, if the steam space is too small, the engine, when running, will tend to reduce the steam pressure in the boiler, causing bubbles of steam to flow from all parts of the heating surface to the surface of the water, and the motion of these bubbles will be so rapid that large quantities of water will be carried with them; this action will show itself in the glass. You prefer to call this action "foaming," we prefer to call it "priming," which we believe is correct, because foaming is caused by mud or other foreign matter carried with the water. Lastly, you say, this action is not dangerous, although it shows that something is not quite right. Now it seems to us that, if there is something which is not quite right about a boiler, there must be something wrong, and, if it could be impressed on those who have charge of boilers that anything which is wrong about a boiler indicates danger, we would have less trouble in the engine-room and fewer boiler explosions. We see no reason for changing our answer; we believe it to be correct.

(74) C. M., New York, writes: Please explain the method of calculating the amount of water which a boiler 4 feet diameter, 16 feet long, with eighty 3-inch flues, will contain. *A.*—First, find the volume in cubic feet of the boiler without any flues. This volume is found by multiplying the cross-sectional area of the boiler by its length. The cross-sectional area of the boiler is equal to $(4)^2 \times .7854 = 12.56 +$ square feet, and $12.56 \times 16 = 200.96$ cubic feet. Second, from this volume subtract the volume of the steam space. To find this volume we must first find the area of the cross-section of the steam space; the form of this cross-section will be a segment of a circle, and, assuming that the water level is 14 inches below the top of boiler, the rise of the segment will be 14 inches, or 1.166 foot. We will find its area by the shortest method: Divide the rise by the diameter of the boiler, $\frac{1.166}{4} = .291$; look for this number (.291) in a table of areas of circular segments (given in engineer's pocket book); alongside of it we find the decimal .1899; multiply this decimal by the square of the diameter of the boiler, $.1899 \times 16 = 3.03$, which is the area in square feet of the segment. Multiply this area by the length of the boiler, $3.03 \times 16 = 48.48$ cubic feet, which is the volume of the steam space. Subtract this steam space from the total volume of the boiler, $200.96 - 48.48 = 152.48$ cubic feet, which would be the volume of the water if there had been no flues. The cross-sectional area of one flue is 7.07 square inches; of eighty flues it will be $7.07 \times 80 = 565.6$ square inches, or $\frac{565.6}{144} = 3.92$ square feet; multiplying this area by the length of the flues we have $3.92 \times 16 = 62.72$ cubic feet. Subtracting this from the volume which the water occupies without the flues, we have $152.48 - 62.72 = 89.76$ cubic feet, which is the volume of water in the given boiler. One cubic foot contains 7.48 gallons, hence $89.76 \times 7.48 = 671.4$ gallons of water in the boiler. The weight of one gallon of water is 8.33 pounds, hence the total weight of water in the boiler will be $671.4 \times 8.33 = 5,592.762$ pounds.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link Belting.
Over 50,000,000 feet of Link Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins and Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Castings for small and medium sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Universal Vise Chucks. Pedrick & Ayer, Philadelphia, Pa.

Link Planer Attachments. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Whiton's Chucks. S. A. Smith, 23 S. Canal st., Chicago, Western Representative.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Jan. 30, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Washington, D. C., procures first-class patents on inventions. Valuable Hand-book on patents free.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

The Sure Grip Steel Tackle Blocks must fill the bill, according to the large sales reported. See advertisement, page 13.

Patents.—Patent soliciting of high class.
D. Walter Brown, 31 Nassau st., New York.
Send for "A Brief History of Patent Legislation in the United States."

25" Upright Drills a specialty. Finely made,
28" great capacity, quickly operated, prices low.
32" Send for list of firms using our Drills. J. E.
36" Snyder, Worcester, Mass.

25" } "Only Drill Press built on
32" } 'Ko-rekt' principles,
37" } even if they come from Jersey."
42" } Gould & Eberhardt, New Ark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations. 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon., 12 Cortlandt st., New York.

Superintendents of industrial establishments will find the *Engineering and Building Record*, published weekly at 277 Pearl st., New York, useful. Municipal and building engineering problems a prominent feature. Specimen Copy, 10 cents.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting
Rods for small connections.
Especially adapted for Valve
Rod for Steam Engines.
T. C. Dill Machine Co.,
Philadelphia, Pa.

Just concluded. "Practical Drawing." By J. G. A. Meyer. Copies of the American Machinist containing the above series of 93 articles sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

H. B. Roelker, 22 Cortlandt St., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller.
Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices.
Consulting Expert and Constructing Engineer.
Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A. Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the American Machinist containing the entire set sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

MANUFACTURES

An electric light plant is talked of at Montezuma, Ga.

H. A. Seymour will build a wood-working factory at Milford, Neb.

Mills & Earsley will build a wood-working factory at Montgomery, Ala.

The United States Rolling Stock Co. will build a rolling mill at Anniston, Ala.

Washburn Bros. will erect and equip a steam saw-mill at Thomaston, Maine.

W. E. Waller & Co. will establish a sash, door and blind factory at Junction City, Ky.

The Birmingham (Ala.) Bridge and Bolt Works, recently burned, will probably be rebuilt.

The Birmingham (Ala.) Railway Supply Co. are considering a large increase of capital stock.

N. R. Keeling, Anderson, N. C., is organizing a company to build an ice machine patented by him.

A company has been formed to build and operate a cable railroad between Providence and Pawtucket, R. I.

The Washington Foundry and Machine Works will establish a foundry and machine shop at Washington, Ga.

The Augusta and Somerville Street Railroad Company, Augusta, Ga., will equip its line with electric cars.

The South Baltimore (Md.) Car Works contemplate building additional shops for the manufacture of passenger cars.

Brundage, Fletcher & Harrow are building a factory at Bridgeport, Conn., in which to manufacture silk ribbons.

The North Side Street Railway Co., Fort Worth, Texas, has been experimenting with electricity, and will return to mule power.

A stock company has been formed, to build a chair factory at Bryant's Pond, Maine. C. H. Adams will manage the business.

The repair shops of the Huntington & Broad Top Mountain Railroad, at Saxton, Pa., recently destroyed by fire, will be rebuilt at once.

A company is organized at Muncie, Ind., known as the Muncie Novelty and Brass Co., with a capital of $100,000. C. F. Hathaway is president.

It is said that a party or parties, who will start a furniture factory at Alpena, Mich., will find plenty of timber at hand, and a good home market.

The Wheelock Engine Company, Worcester, Mass., have their new shops nearly completed. They expect to move about the first of April.

The George F. Blake Manufacturing Company, Boston, Mass., have moved into their new shop at East Cambridge. The new shop is 100x400 feet.

Plans have been prepared for a new brass foundry at the Louisville and Nashville Company's machine shops, New Decatur, Ala., and the present iron foundry will probably be enlarged.

The Detrick & Harvey Machine Company, Baltimore, Md., have received an order from the War Department for three threading and slotting machines for use at the Watervliet Arsenal.

J. Fred W. Harris & Co. have located at Binghamton, N. Y., for the purpose of manufacturing small lathes, milling machine vises, centers, other small tools, and to build special machinery.

The H. A. White Manufacturing Company, of Leicester, Mass., has recently been incorporated. Its purpose is to manufacture and deal in card clothing and other mechanical appliances. The capital stock is $80,000.

The A. B. Farquhar Company, York, Pa., have nearly completed an addition to their works, 120 x100 feet, three stories, of brick. The floors are all asbestos filled. It will be used as the hay-press department.

The Charlotte (Mich.) Common Council has voted John L. Dolson a bonus of $5,000 in consideration of his erecting a brick carriage factory, with a capacity for 200 workmen, and have the same in operation by October 1.

The Ames Shovel Works, North Easton, Mass., having experimented with the use of crude oil in four or five furnaces, are so well satisfied with the results that they will equip the rest of their furnaces for the same fuel.

Our readers will remember that in our issue of June 20, 1889, we illustrated a hollow mill, made for the trade by Ernest F. Robbins, Needham, Mass. Mr. Robbins informs us that he has had an excellent trade in this mill, and that in his other business of light machinery, models, tools, etc., trade is very good indeed, he being badly driven with orders.

Fire in the matting factory of Joseph Wild & Co., Brooklyn, N. Y., recently, did about one hundred and fifty thousand dollars damages. The three-story structure was completely destroyed. The factory employed 150 to 175 hands.

There is water-works agitation at Mansfield, Tex.; Eureka Springs, Ark.; Greenville, Ga.; Clay City, Ky.; Elkton, Md.; Bridgeport, W. Va.; Plainsville, Conn.; Loup City, Neb.; Lincoln, Neb.; Manhattan, Kan.; La Grande, Ore.; Hillsboro, Tex.

New England parties have offered to establish a cotton factory in Aberdeen, Miss., supplying $100,000 if the citizens will subscribe as much. The proposition has been accepted by the citizens, thus making the capital stock of the proposed mill $200,000.

The Overman Wheel Co., of Chicopee, Mass., will build another addition to its plant early in the spring. This company has purchased the Whittemore Agricultural Tool Works in Chicopee, and the buildings are to be removed, to make place for the addition.

The Eagle Machinery Works, Bucyrus, Ohio, send us their annual catalogue of clay-working machinery, engines and boilers, shafting, etc. The catalogue is well illustrated and printed, and contains a good deal of information for those interested in working clay.

Rathbun & Co., of Deseronto, Ont., who have obtained possession of the M. D. Moore & Sons sash, door and blind factory, Lowville, N. Y., that has been idle for a long time, will operate it to its fullest capacity. The style will be the Lowville Sash, Door and Blind Company.

Warner & Swasey, Cleveland, Ohio, are not only busy on their regular line of iron and brass-working machine tools, but are building a 16" telescope for Carlton College, Northfield, Minn., and a 45 foot, and 26½ foot steel dome for the new National Observatory at Washington.

Frazer & Chalmers, manufacturers of mining machinery, at Chicago, Ill., will establish a branch manufactory near London, England. This company do a business of about $3,000,000 a year. As they ship largely to Europe, Australia, Asia and Africa, it is thought best to manufacture for this trade in England.

The Norton Iron Works, of Ashland, Ky., and the Kelly Nail Company, of Ironton, O., will bond their present plants for $50,000 each, and will unite in building a steel plant at Ashland, Ky., on the bank of the Ohio River. An equivalent to $100,000 has been obtained in donations, exemption from taxes, and promised rebates on freight charges.

A new industry is about to be started at Muncie, Ind., to be known as the "Muncie Architectural Iron Works." Work on the new buildings will be commenced at once. There will be a building 160x40, two stories high, for the machinery; a foundry 125x70, and a building 85x40, to be used as warehouse and shipping department. A general line of architectural iron work will be made, and when in full working order employment will be given to two hundred men.

The showing of new corporations formed in Connecticut during the year 1889 is an excellent one for this State. One hundred and one new companies with an aggregate net increase of capital of nearly four million dollars, indicates a most satisfactory industrial activity. And when to the record is added the numerous small manufacturing enterprises, not incorporated, that are destined to become important factors in the growth of our cities and towns, the showing is indeed a gratifying one.—*The Weekly Record.*

The Pond Machine Tool Co., through its selling agents, Manning, Maxwell & Moore, 113 Liberty street, New York, has received an order from the Ordnance Department of the U. S. Government for ten large lathes, for the work of turning, boring and finishing guns of 8 to 12 inches caliber. The contract amounts to $247,800. The time of delivery extends over a period of about three years, which enables the company to take care of its regular work promptly, and does not materially reduce the production of its shops for regular railroad and machine shop trade.

A Baltimore press dispatch says: A year ago a prominent official of the Pennsylvania Steel Works, at Sparrow Point, predicted that that company would ultimately include in its business the casting of heavy guns and building of steel steamships. Before these two great industries could be added, a Bessemer and rail mill for the conversion of the iron product into steel was necessary. The erection of this was commenced some months ago, and now plans are being made that will result in the introduction of a plant by which the Pennsylvania Steel Company will be enabled in the near future to build the largest steel and iron steamships. Mr. Luther F. Bent, the president of the company, and F. W. Wood, general manager, are devoting their whole attention to the plans at Steelton, Pa. Colonel Franklin, superintendent at Sparrow Point, said last night that the company would confine itself at first to building coastwise steamships, as the laws of the United States prohibited them from being built in a foreign country; but after a while Sparrow Point would enter into competition with the great shipbuilding firms on the Clyde. He thought it possible for steamships to be turned out as cheaply in this country as abroad.

Machinists' Supplies and Iron.

NEW YORK, Feb. 15, 1890.

Iron—American Pig.—The majority of consumers are receiving sufficient supplies from contract deliveries and there is comparatively little new business; what there is being confined to small consumers who buy only for current demands. A few standard brands are still quoted at full prices, but the general tone of the market is easier and concessions are readily obtained upon most brands. We quote standard brands No. 1 X Foundry, $19.50 to $20; No. 2, $18.50 to $19; Grey Forge, $17.50 to $18.

Scotch Pig.—The local demand continues light, and it seems unlikely that Scotch pig will ever again be extensively used in this country. The Glasgow market is unsettled and easy.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Foreman boiler maker would like to make a change. 25 y'rs exp. Have refs. F. B., AM. MACH.

Wanted—Position by mech. draftsman. Can give refs. Salary moderate. P.O.Box 1141,New London,Ct.

A mechanical draftsman and designer with practical exp. wants position. Box 88, AM. MACHINIST.

Wanted—Competent draftsman and designer on machine tool work. State fully, age, experience, and wages required, to Box 82, AMERICAN MACHINIST.

Wanted—A thorough machinist as gen'l foreman and inspector. Must speak German. Name age, exp., and pay wanted. Box 87, AM. MACHINIST.

Mechanical draftsman, thoroughly competent in machine and engine designing, desires position in vicinity of New York. Box 86, AM. MACHINIST.

Wanted—One ass't draftsman and one pattern maker to work on fine machinery. Young men preferred. Address Elgin Nat'l Watch Co , Elgin, Ill., giving reference, age and past experience.

Wanted—Foreman for core-room in malleable iron foundry. Must be competent to take charge, and fully understand making cores. Address, stating wages wanted, experience and refs., D., AM. MACH.

Wanted—A permanent position as sup't, ass't sup't or head draftsman, by an energetic young man who held such office before. Great exprerience; the best scientific training. "Steady," AM. MACHINIST.

A good organizer, economical, energetic manager, thorough machinist and pattern maker, good draftsman, designer and office man, wants engagement. Gilt-edge refs. Moderate compensation. Box 83, AMERICAN MACHINIST.

Wanted—Five tool makers, men accustomed to work in small work and from drawings; also four model makers. Steady employment and good pay. Crrrespondence solicited. The National Cash Register Co , Dayton, Ohio.

Wanted—A position as superintendent of malleable iron works. 12 years years' experience; well acquainted with air furnace and all kinds of iron, and the business in all its branches. Best of references. Address Box 84, AMERICAN MACHINIST.

Wanted—A first-class and capable foreman to take charge of our wrench and hardware specialty department. Must have good mechanical and executive ability. Address, with full particulars, Capitol Mfg. Co., Chicago, Ill.

A thoroughly practical man wants position as traveling salesman or branch manager for some 1st-class manufacturer of machine tools or gen'l mach'y. 10 years' exp., thoroughly posted, and can sell goods, contract and construct. "Salesman," AM. MACH.

Correspondent and salesman wanted by a large manufacturing company near New York City. A gentleman of education, and of good mechanical and commercial experience, to conduct correspondence relating to engineering and other products. Address, stating age, experience, references, and salary required, Box 85, AMERICAN MACHINIST.

Salesmen can add to their incomes by selling our goods on commission. Commissions to one salesman, who devoted only one hour daily to our goods, averaged twenty-five dollars per month for the past three months. Our goods have been on the market for twenty-one years, are well known, and are first-class in every respect. Address Box 72, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head a 35 cents per line, each insertion.

Cheap 2d h'd Lathes & Drills. S. M. York, Clev'd, O.

Graduating Machines. A. T. Koopman, Chicago.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Wanted—48" Pratt & Whitney Gear Cutter. Address, with particulars, Box 80, AM. MACHINIST.

Castings of every description and machinery built. Address Cedar Point Foundry, Port Henry, N. Y.

For Sale—One heavy Hewes & Phillips Planer, 32"x32"x8 ft., in good order and repair. Address Capitol Mfg. Co., Chicago, Ill.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Simonsen-Walter Mfg. Co., Jefferson City, Mo., with modern foundry, machine and wood-work plant, wants spec. to manuf. for Western trade.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—Two lathes about 3 ft. 6 in. bed, 13 in. swing, with two clutches on countershaft, adjustable tool rest, cone for 3 in. belt. One engine lathe with short bed, 20" swing, and hollow spindle. Address Capitol Mfg. Co., Chicago, Ill.

For Sale—New, A Brown & Sharpe No. 2 Tapping Machine, originally purchased as a spare machine, and never used. Tail rest is adjustable. Tap reverses automatically, and is backed out at quick speed. Dresses taps up to 3-4". Inquire of the Neverslip Horseshoe Co., 36 India Wharf, Boston, Mass.

BRADLEY HAMMERS AND FORGES.

The BEST HAMMERS in the WORLD RUN BY BELT.

Over 1500 In Use.

Three Styles, 15 lb. to 500 lb. Heads.

Our FORGES heat irons fast enough to keep Hammers and men fully employed.

Send for Catalogue and Prices.

BRADLEY & COMPANY, Syracuse, N. Y.

63 Murray St., NEW YORK. 99 Sudbury St., BOSTON.

NEW BOOKS.

HANDBOOK OF ENGINE AND BOILER TRIALS, And the use of the Indicator and the Brake. By R. H. Thurston, Director of Sibley College, Cornell University. Very fully illustrated. 8vo cloth ..... $5.00.

LOCOMOTIVE-ENGINE RUNNING AND MANAGEMENT. A practical Treatise on the Locomotives Engines, showing their performance in running different kinds of trains with economy and dispatch. Also, directions regarding the care, management, and repairs of Locomotives and all their connections. By Angus Sinclair, M. E. Illustrated by numerous engravings. New edition with additions (1890). 12mo, cloth, $2.00.

Sent postpaid on receipt of Price.

JNO. WILEY & SONS, NEW YORK.

SEND FOR CATALOGUE.

WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

"Star" Foot Lathe Swings 9x25 in. | LATHE | Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers. | LATHE | Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y.

PATENTS THOMAS P. SIMPSON, Washington, D. C No atty's fee until Patent obtained. Write for Inventor's Guide.

PRESSES, DIES, AND OTHER SHEET-METAL TOOLS

FERRACUTE MACHINE CO. BRIDGETON, N. JERSEY U.S.A.

ALUMINUM, $2 PER POUND.

THE PITTSBURGH REDUCTION COMPANY, 95 Fifth Avenue, Pittsburgh, Pa., U. S. A., offer commercially pure aluminum at the following rates at Pittsburgh, Pa.:

Lots of 1,000 lbs. and over.....$2.00 ℔
Lots of 500 lbs. and over..... 2.25 ℔
Lots of 100 lbs. and over..... 2.50 ℔

Metal guaranteed to be equal in quality to the best metal manufactured by any other process.

Prices on sheets, wire, tubes or castings given upon application.

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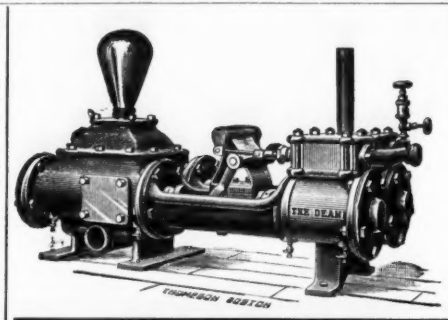

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New York, Boston, Chicago, Philadelphia, St. Louis,
Manufacturers of
STEAM and POWER
PUMPS
FOR ALL PURPOSES.
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SHEET STEEL.

Of various qualities and all gauges, for Knives, Saws, Scissors, Springs, &c.

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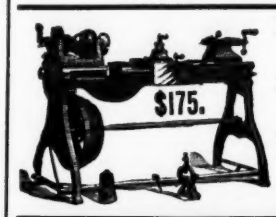


Improved Screw Cutting Foot and Power LATHES

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

THE SEBASTIAN-MAY CO., 167 W. 2d St., CINCINNATI, O.

MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE

Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.

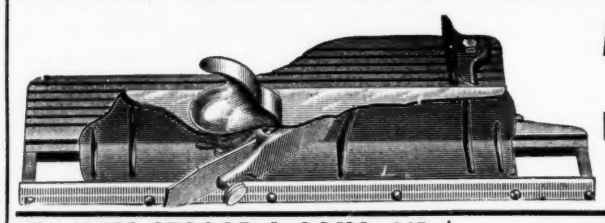
CAN BE FORGED HOT.

Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Ingot metal for car and engine bearings. Spring wire.

ANSONIA BRASS & COPPER CO., Sole Manufacturers.

Send for Circular CHICAGO. NEW YORK.

PATTERN MAKERS' SHOOT PLANE & JACK BOARD.



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Box 3600.
BOSTON, MASS.
SEND FOR CIRCULAR.

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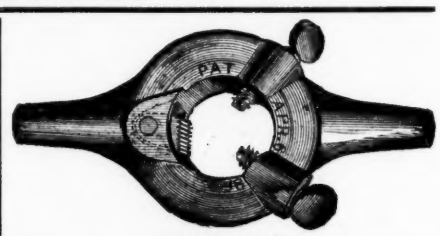
Gold Medal, Paris, 1889.

ALL KINDS OF Steel in Stock. Importation Orders Promptly filled.



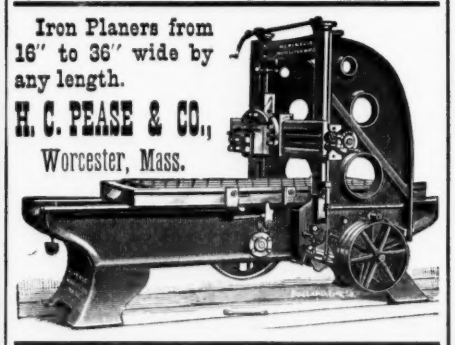
CLASS "C."

This style is made from 1 in. to 8 in. or larger. Specially adapted to axle and roll turning, and Boring Bars. Guaranteed not to slip. Write for catalogue showing the different styles.

MANUFACTURED BY
THE MIDDLETOWN (OHIO) MACHINE CO.

Iron Planers from 16" to 36" wide by any length.

H. C. PEASE & CO., Worcester, Mass.



IF YOU WANT A STRONG, ECONOMICAL ENGINE

EITHER HORIZONTAL OR VERTICAL,

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Twelve Hundred Engines in use.

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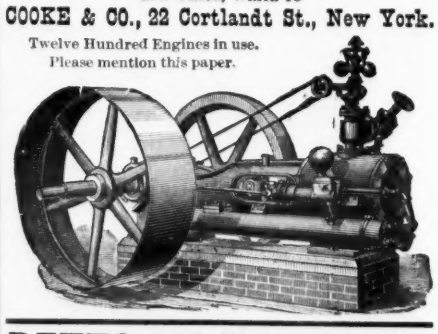


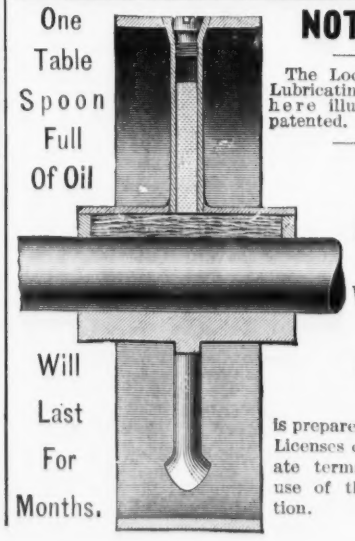
Pease Iron Planers.

Following sizes carried in stock:

20 in., 22 in., 24 in., 26 in. & 30 in.

HILL, CLARKE & CO.,

156 OLIVER ST., - BOSTON, MASS.



NOTICE.

The Loose Pulley Lubricating Device here illustrated is patented.

T. R. Almond, 85 Washington Street, Brooklyn, N. Y.

is prepared to grant Licenses on moderate terms for the use of this invention.

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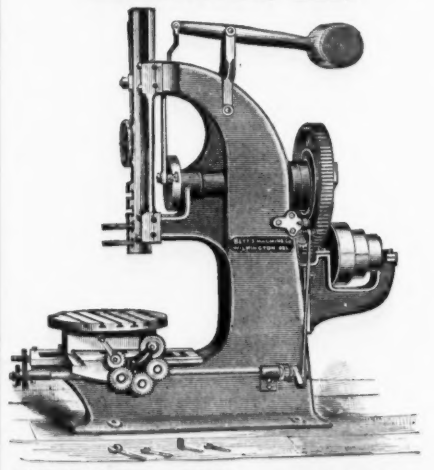

MACHINE TOOL BUILDERS.

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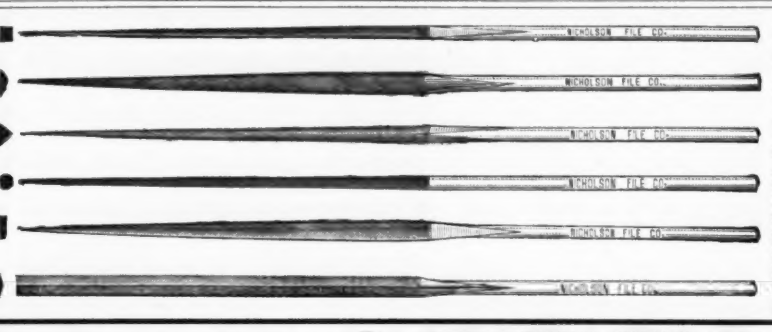

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CRUCIBLE AND OPEN HEARTH
CAMERON SELF-HARDENING
STEEL
ESTABLISHED 1859.
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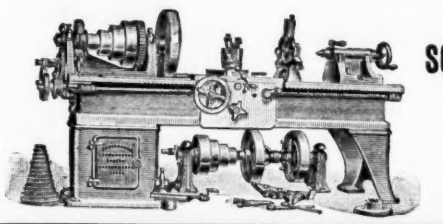
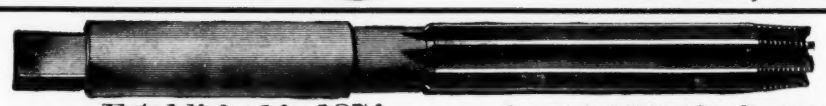
BRANCH OFFICES: 12 Cliff St., New York. 127 Oliver St., Boston. 228 Lake St., Chicago.

FOR IMMEDIATE DELIVERY.
16-20, 20 & 24 Inch ENGINE LATHES,
14 & 16 inch BRASS LATHES,
—AND—
SCREW MACHINES IN LARGE VARIETY.



Bridgeport Machine Tool Works,
E. P. BULLARD, Prop.
BRIDGEPORT, CONN.



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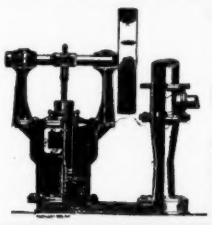

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No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*

SECOND-HAND MACHINE TOOLS.
Following Tools are guaranteed to be in first-class order.
Univ. Milling Machine. No. 3 Brainard.....$400
Planer 24″x24″x6′. Niles Tools Wks.....375
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Engine Lathe 17″x8′. Muller.....200
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Following Tools are in excellent running order. Modern patterns.
Planer 26″x26″x6′. N. Y. St. Eng. Co.....$350
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Drill Press 28″ wheel feed. Bickford.....100
Following Tools are old style. Fair running order.
Planer 46″x36″x18′. Niles.....$650
Engine Lathe 18″x6′. Shepard, Lathe & Co.....175
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Above prices are for net cash f. o. b. Cincinnati.
ADDRESS THE G. A. GRAY CO.,
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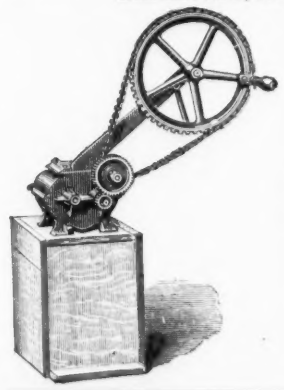
ROOTS' NEW ACME HAND BLOWER.
For Blacksmiths, etc. Slow Speed, Positive Blast. Is durable. Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.



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CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., } 22 CORTLANDT ST.,
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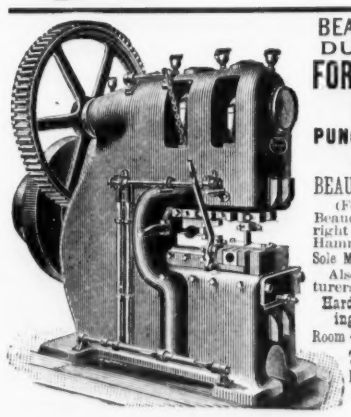

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FORGING PRESS,
PUNCH AND SHEARS.
BEAUDRY & CO.
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Sole Manufacturers.
Also Manufacturers of
Hard Coal Heating Forges.
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ROPER'S
PRACTICAL HAND BOOKS,
BY STEPHEN ROPER, Engineer.
These books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire and Marine. Any engineer or fireman who wishes to be well informed in all the duties of his calling should provide himself with a full set. They are the only books of the kind ever published in this country, and they are so plain that any engineer or fireman that can read can easily understand them. For sale by all Booksellers.
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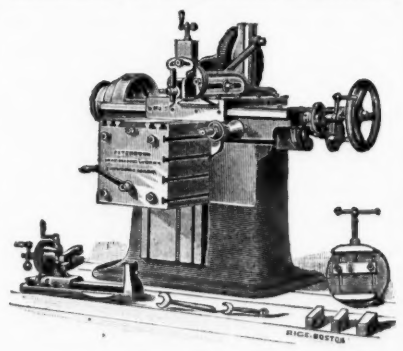
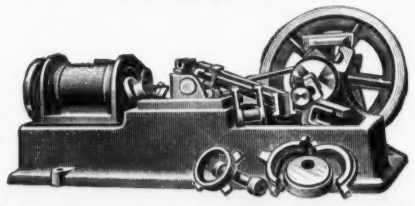
FITCHBURG MACHINE WORKS
Manufacturers of METAL-WORKING MACHINES.



OFFICE AND WORKS,
13 to 21 MAIN STREET, Fitchburg, Mass.
Send for Catalogue (E.)

Castings for High Speed Steam Engine.
CYLINDER, 4 in. x 4 1-4 in.



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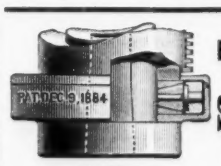
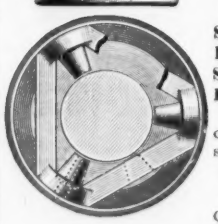
Sets of Castings for Engine illustrated above, with *Cast-steel Shaft, Connecting Rod* and *Rock Shaft*, and *Brass Bearings*, boxed and delivered on boat or cars, in this city, on receipt of $38.00. This includes a *blue print* of working drawing.





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ANTI-FRICTION
Step or Thrust Bearing
FOR
Lathes, Drills, Worm Shafts of Elevators or Hoists, Jack Screws, Mill Stones, Water Wheel and Propeller Shafts.
Bearings of all sizes made to order, and patent rights for sale by
G. L. BROWNELL,
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Correspondence Solicited.

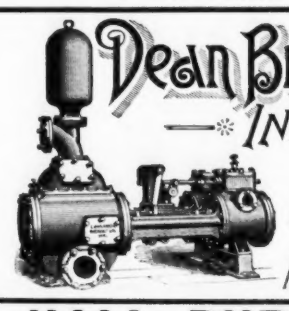
REDUCED PRICES OF LeCOUNT'S STRAIGHT TAIL DOG.

To be driven from a Stud in the Face Plate.

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	¾	$0.60	10	2¼	$1.35
2	⅞	.70	11	2½	1.45
3	1	.70	12	3	1.60
4	1⅛	.80	13	3½	1.80
5	1¼	.80	14	4	2.10
6	1⅜	.95	15	4½	2.75
7	1½	.95	16	5	3.25
8	1¾	1.10	17	5½	4.00
9	2	1.20	18	6	5.00
1 Set to 2 in.		7.80	Full Set.		31.10

C. W. LeCOUNT, South Norwalk, Conn.

Dean Bros. Steam Pump Works,
INDIANAPOLIS, IND.



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HORIZONTAL AND VERTICAL PUMPS.
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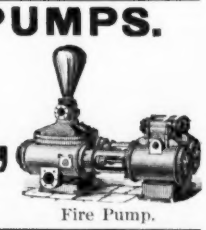

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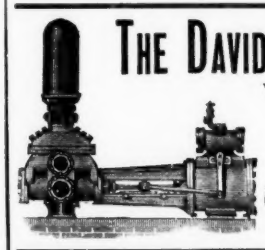

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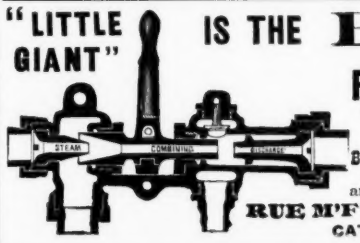

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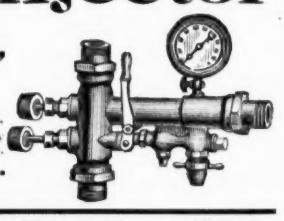

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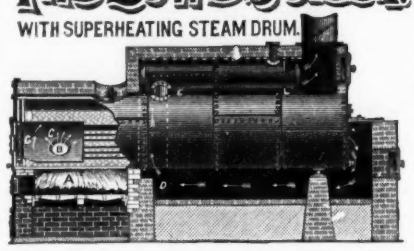

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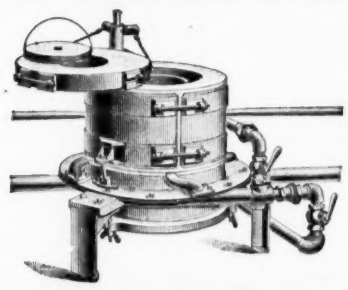

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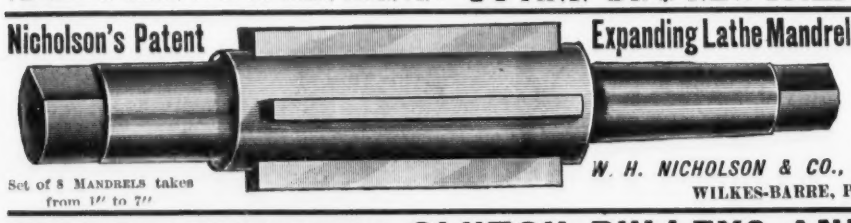

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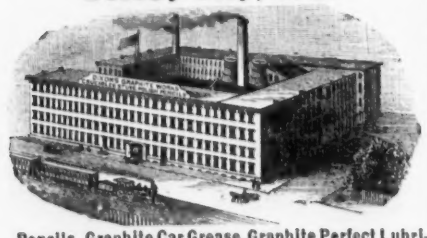

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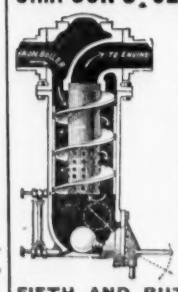

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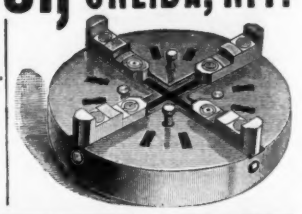

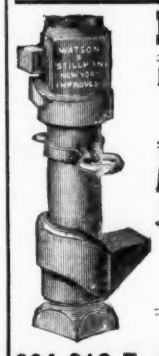

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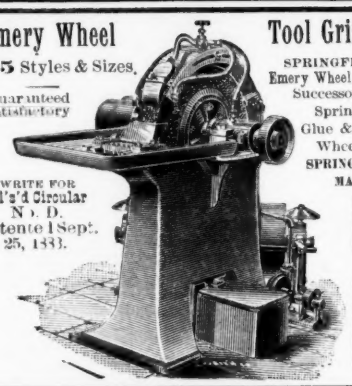

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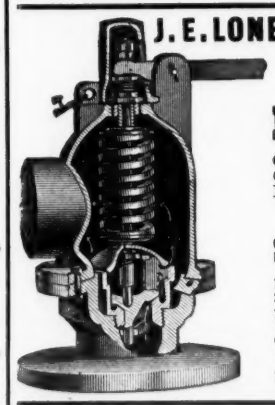

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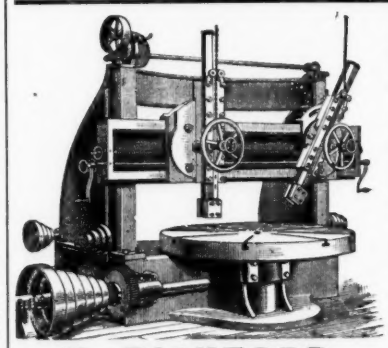

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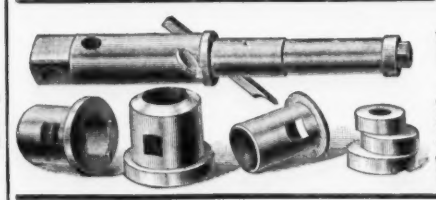

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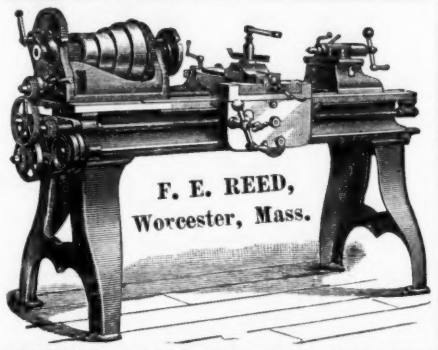

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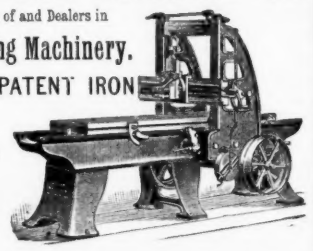

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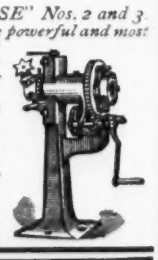

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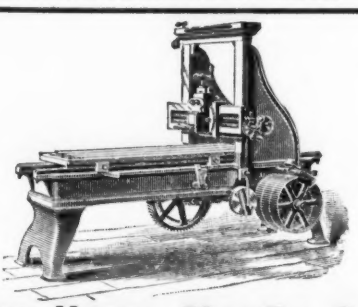

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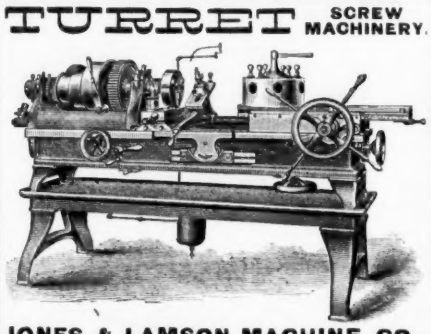

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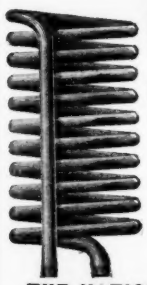

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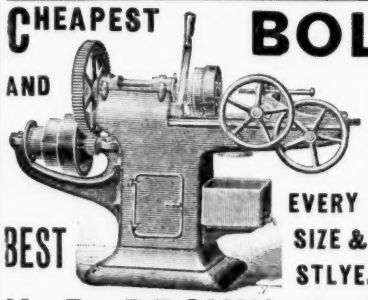

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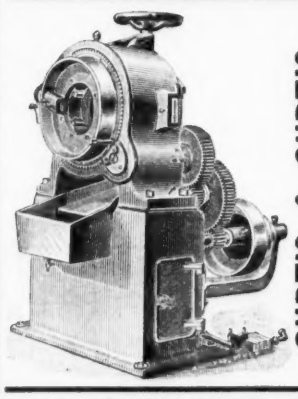

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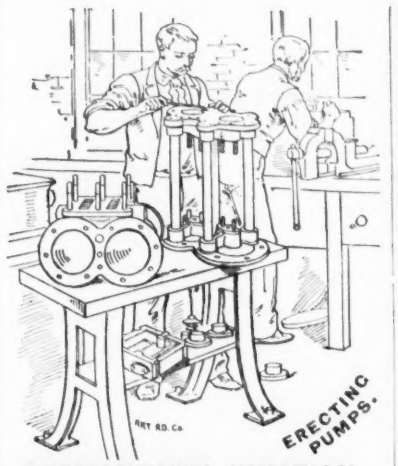

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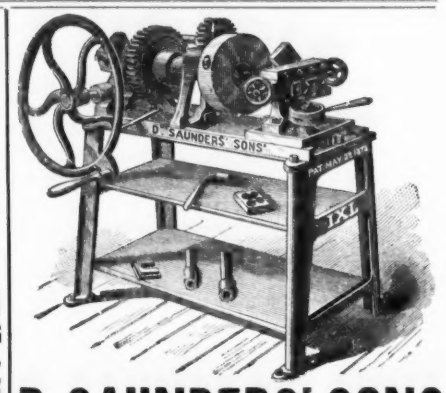

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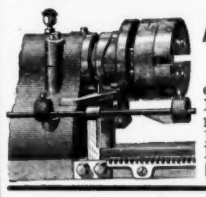

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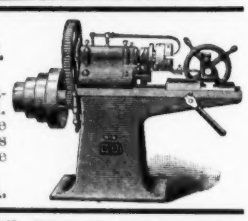

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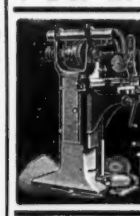

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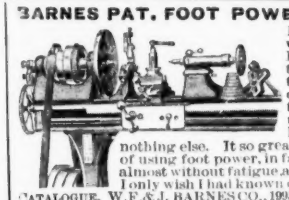

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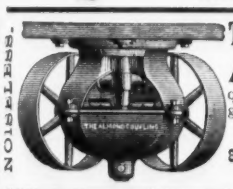

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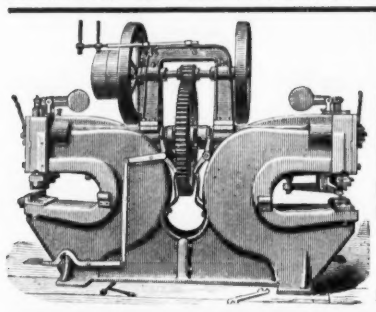

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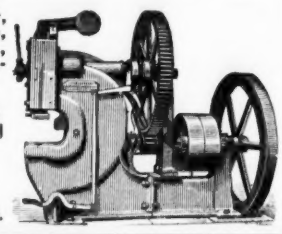

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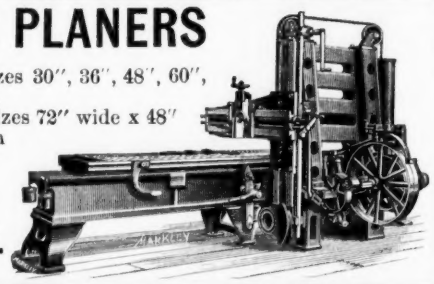

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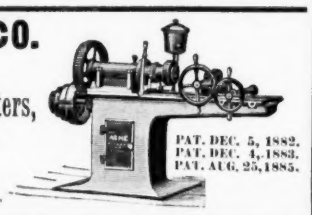

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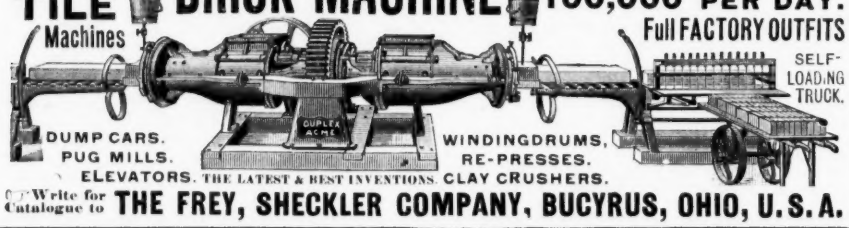

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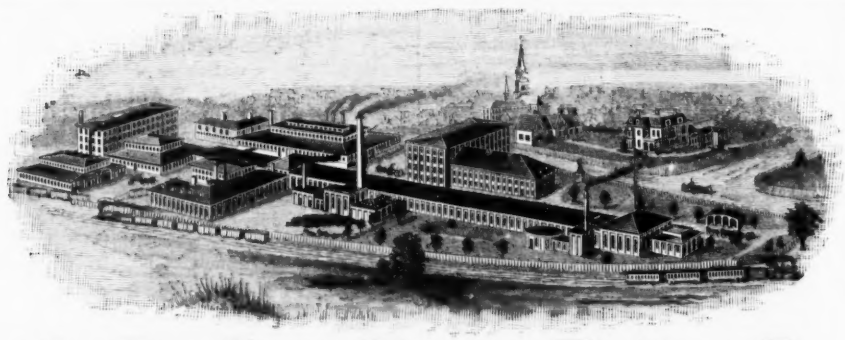

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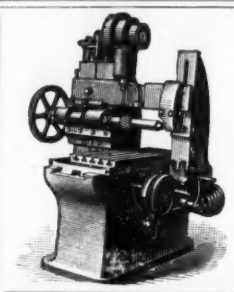

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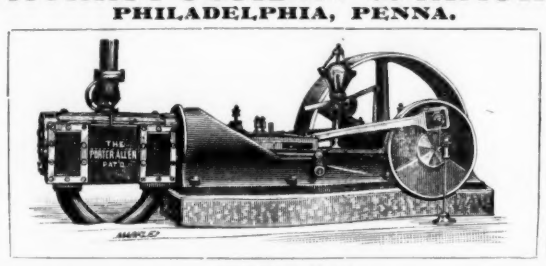

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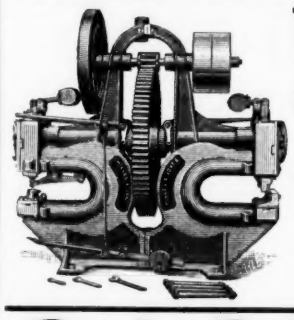

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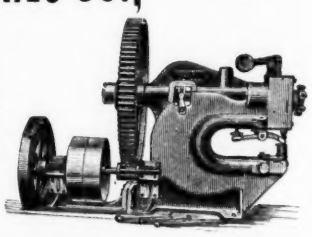

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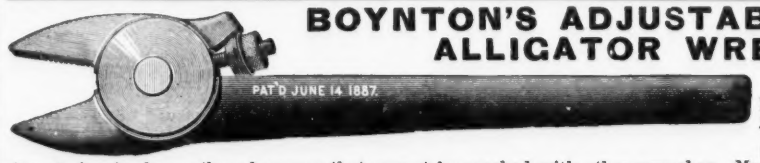

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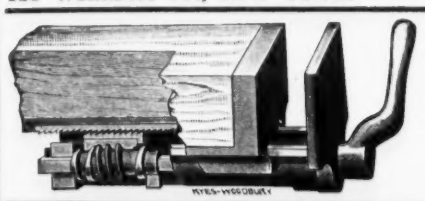

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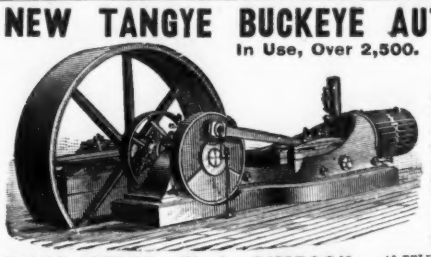

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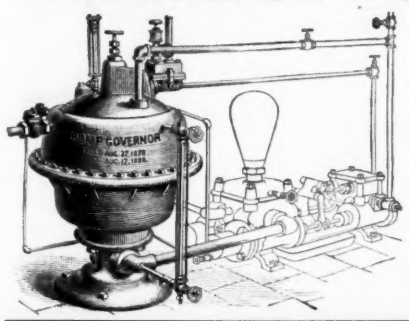

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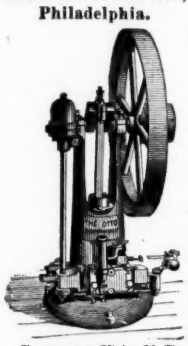

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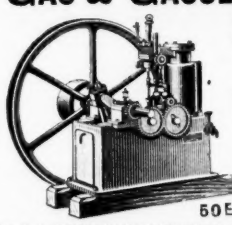

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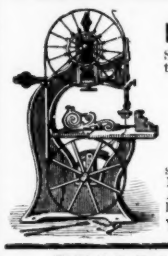

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☞ Indexed feeds on all machines.
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☞ Each machine furnished with a vise.
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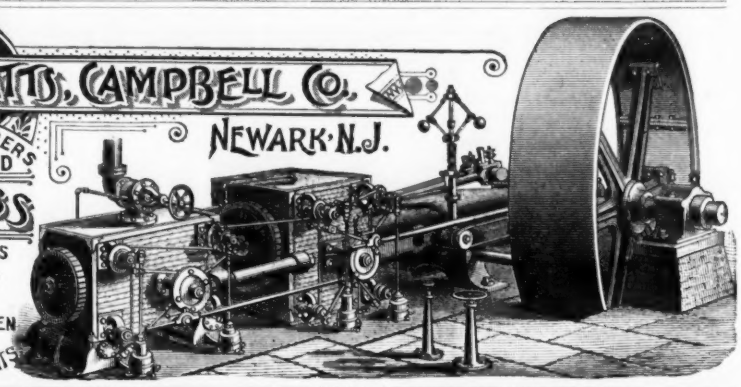

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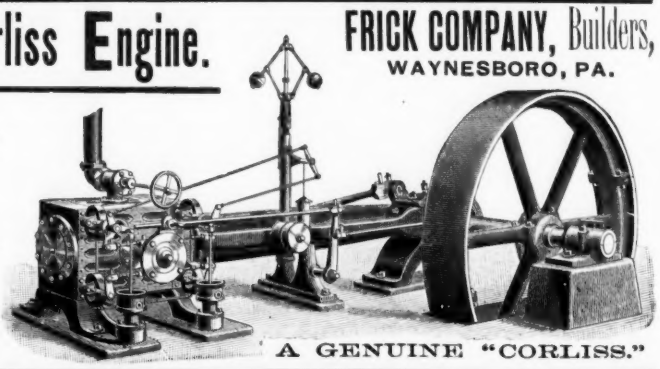

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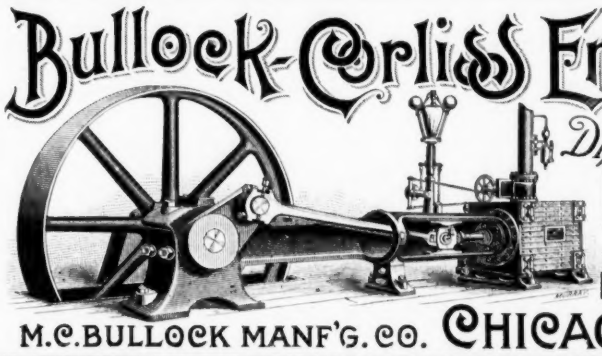

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" "	16 in. x 6 ft.	Fitchburg, 2nd hand	A1.
" "	16 in. x 6 ft.	"	new.
" "	16 in. x 6 ft.	Wright,	new.
" "	16 in. x 6-8-10 ft.	Hendey	new.
" "	ditto, with tapers,	"	new.
" "	18 in. x 8-10 ft.	"	new.
" "	ditto, with tapers,	"	new.
" "	18 in. x 8 ft.	Fitchburg,	new.
" "	20 in. x 10 ft.	Wright,	new.
" "	21 in. x 8-10 ft.	Fitchburg, 2nd hand,	A1.
" "	24 in. x 12 ft.	"	new.
" "	24 in. x 12 ft.	Wright,	new.
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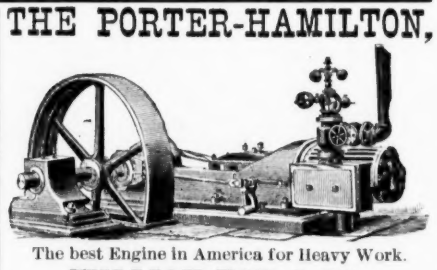

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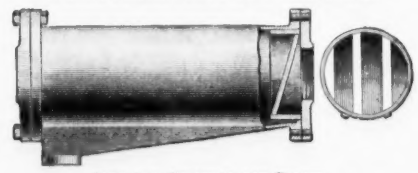

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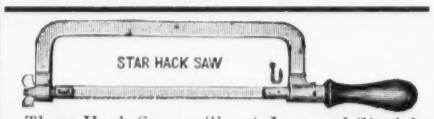

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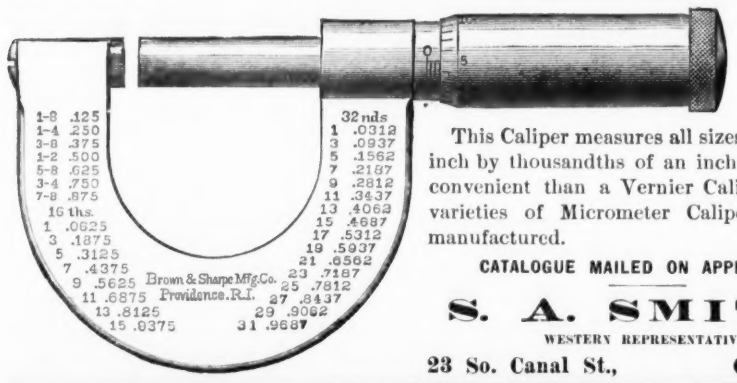

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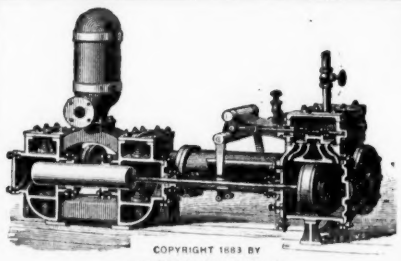

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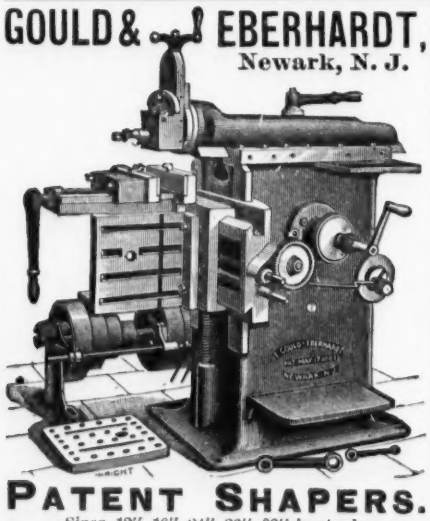

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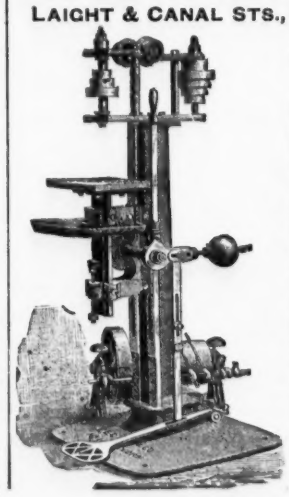

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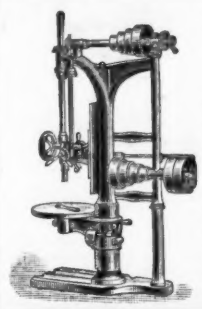

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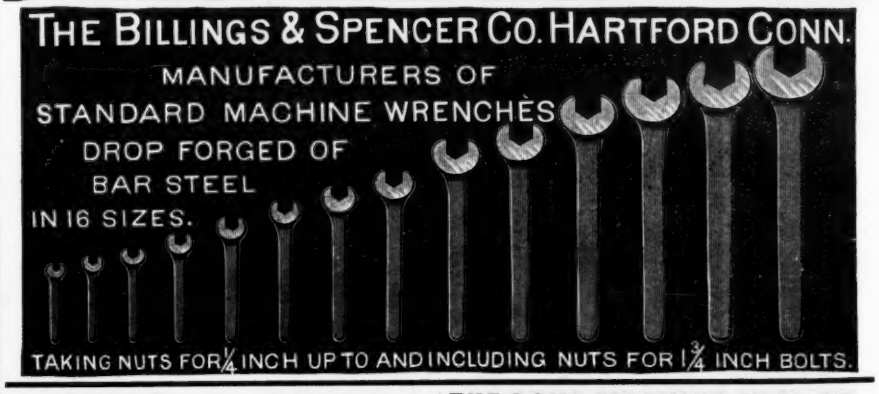

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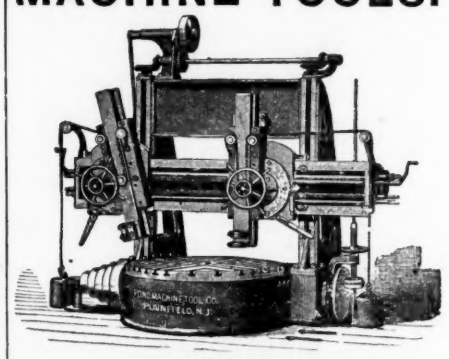

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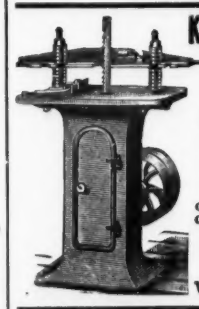

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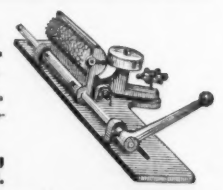

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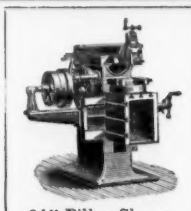

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